

# 21·C

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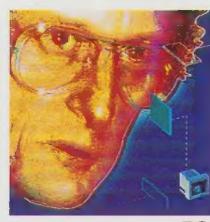
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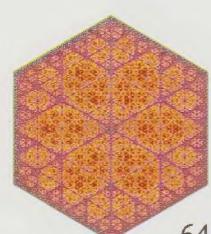
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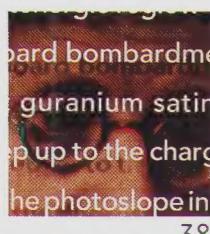
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IN THEORY, SOFTWARE HAS FINALLY LEARNT HOW TO WRITE, INTERPRET HUMAN HANDWRITING AND DECODE BAD SPELLING. ALL IT NEEDS NOW IS TO KEEP UP WITH OUR CHANGING LANGUAGE.

# avoiding software block

BY FRED HARDEN

In her recent book *Slaves of Chic: an A-Z of Consumer Pleasures*, Joanne Finkelstein points to the introduction of the Filofax-type diary as marking the death of the personal diary and, with it, the demise of a significant literary genre. "The contemporary diary is gutted of commentary but loaded instead with factual detail.... The scribbled entries of telephone numbers and unrelated snippets of information which may find their way onto the open page are only momentarily meaningful. Such diaries record great activity but give it no interpretive value."

As the info-lust grows with the craving for accurate information, for instant trivial details at your finger tips, the Filofax gives way to the electronic organizer. This dispassionate recorder of names, dates and numbers is stripped of even the smallest emotional details you might interpret from your handwriting and marginalia in a paper diary. A lot of people now find it difficult to write even a business letter, making a ready market for the collections of formula documents available on disk (Get even with WordPerfect's 100 Letters of Toadying, Insult, Anger, and Legal Demand!)

However, somewhere between the e-mail network in the office and the explosion in online services and the Internet, there's been a growing return of text-based communication. Once again it is carrying content, has context, and creative and emotional substance. Sure, much of the traffic is still nuts and bolts, but the process of writing, or rather typing/keyboarding, asks for more. And judging from the e-mail in my box each day, there is a wider concern for the more careful choice of word, or phrase, that carries a witty or poetic overtone.

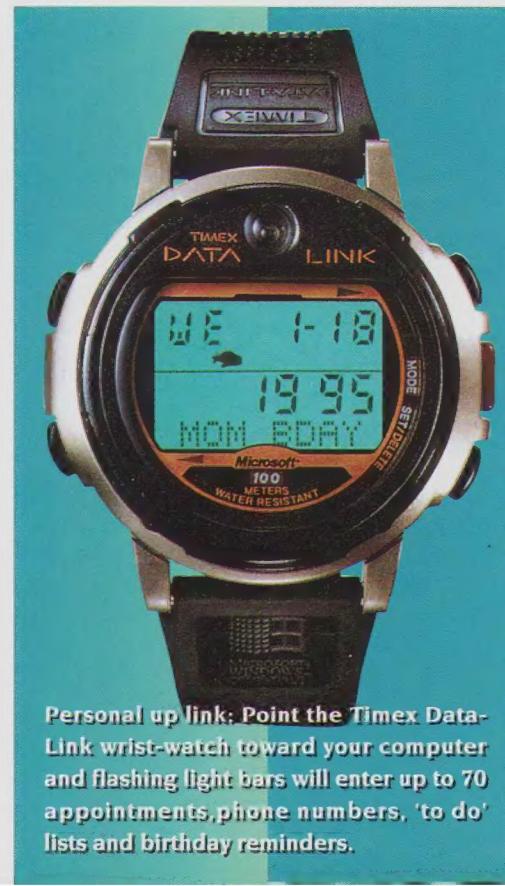
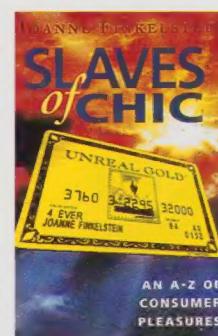
If the personal diarist of the future will be digital, then you should be selectively keeping your e-mail, and trying to improve the richness of your text-based communications.

If the computer on your desk is going to help you provide the missing 'commentary' it is also going to have to take over the task of organization provided by a diary. This means that either the computer shrinks

to the size of an organizer, or that it is linked to your information network.

As every 21•C reader knows, everything in life can be fixed with the purchase of a new product, so here's some tools to start the process.

The Apple Newton PDA still refuses to read the hand-writing on the wall and die, or is that d!\*? Its latest incarnation is the Model 220 which comes equipped with enough memory (2Mb) to actually hold an application or two in RAM while freeing up the PCMCIA card slot to take something useful (such as a modem). This is the Newton that we would have been really impressed by if it was the first model released; then we might have paid its high price, without complaint. The attraction now is that there has been enough time for software developers to come up with some clever vertical market applications. The fold-over case and retractable pen are improvements.



**Personal up link:** Point the Timex Data-Link wrist-watch toward your computer and flashing light bars will enter up to 70 appointments, phone numbers, 'to do' lists and birthday reminders.

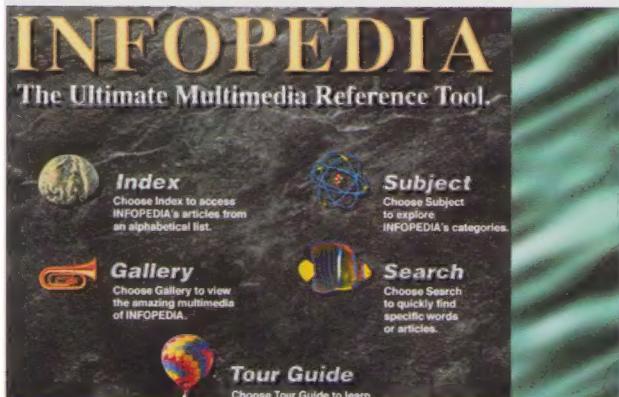


Avoid indecipherability, send the whole page.

The credit card size of the PCMCIA slot, although small, is still a factor that dictates the amount of miniaturization that's possible if it's going to have any robustness. Each time I pull out or insert a PCMCIA network-card I expect it to disintegrate. The Motorola Personal Messenger 100D radio modem somehow has the feeling of permanence – something to do with weight, the materials, and finish. Slide this into your Newton or notebook portable and for the price of a cellular phone connection you can connect to your regular Internet supplier or e-mail provider. Access through your local phone service provider allows you to send and receive faxes. The small fold-up antenna and the battery pack are really the things that take up space and draw attention. You can pocket the Motorola and only plug it in when you want to read your messages; it will store them as long as the batteries last, but it's still another device to carry.

Then there's the personal communicators, the PDAs with a wireless modem built in. Marc Porat and Andy Hertzfeld, one of the original Macintosh architects, have pushed software company General Magic into the limelight with heavy lobbying for their software GUI. It's the one you'll see on a number of handheld devices (expect real-soon-now announcements from Matsushita and Philips). The first to be demonstrated was the Motorola Envoy, but it appears that Sony may be the one that reaches the market. The Sony Magic Link has mail, fax and data functions

Somewhere between the e-mail network in the office and the explosion in online services and the Internet, there's been a growing return of text-based communication.



Software, hard facts and hot wired to nine reference books.

and the Magic Cap software avoids the handwriting recognition problems by sending pictures of the handwritten/drawn screen (Digital Ink) and by providing a touch screen keyboard that allows short message entering by pen or finger. You should be able to start using these devices from the moment you connect, a big plus in a computer environment rarely known as friendly.

None of these devices fit in your pocket, but if you'd like something strapped to your wrist, the Timex Data-Link watch is the closest thing to techno-magic around.

Instead of using a cable or infra-red transmitter to download your Windows Schedule+ information from your desktop computer, just point the watch towards the screen and a series of flashing bars of light will enter up to 70 entries of appointments, phone numbers, 'to do' lists and reminders of birthdays. The watch warns you a week in advance of a special date, flashing an urgent reminder on the day, and beeps in advance of a scheduled meeting. In design it's definitely in the chunky class, but it's water resistant to 100 meters if you need to be reminded of your mother's birthday while underwater.

It's the two-way-contact function of the communicators that's attractive, but if your need is simply for a pager that goes where you do, there's a whole range of watches with pager features due to hit soon. Until now the alphanumeric screens on watches

have been large and ugly, but these are slim and functional, if not exactly attractive.

The Seiko Message Watch has an FM chip that receives voice-mail notification and accurate time (it automatically updates every 20 minutes to the Bureau of Standards electronic clock). There's a version also from Swatch, designed with their usual flair. These products are being marketed as "the pager for the rest of us." Paging service costs are low and the watches are priced as a consumer fashion item.

Finally, one writer's tool that will help you lucidly express the 'inner' you: the Infopedia.

Shrewdly realizing that you can only have one disc at a time in your CD-ROM drive and if you're writing you want to have access to a good dictionary and thesaurus, Futurevision Multimedia's Infopedia CD-ROM gives Microsoft's Encarta'95 a heavy shake-up. Its multimedia content may be less, but by including the text and images of Funk & Wagnall's Encyclopedia, World Almanac and Book of Facts, and with maps from the Hammond Atlas, it has the pedigree. It is tricked up with some nice animation and sound-and-movement, but the reason I'm tempted to leave it in my disc drive is because it also contains the Miriam-Webster's Collegiate Dictionary (10th edition), along with their Dictionary of English Usage, Dictionary of Quotations and Biographical Dictionary, and they've thrown in Roget's 21st Century Thesaurus. There are good hypertext links that let you jump from section to section and every word is 'hot' to the dictionary; just click on it for immediate pronunciation. My only regret is that as a tool for online mail creation it doesn't talk the language of cyberspace. Don't bother looking up words like Internet in the Infopedia, it's not there (nor is it in Encarta'95. Encarta does have an off-hand listing for ARPANET though).

If this really is a trend, then we'll need new tools with up-to-date information that reflect how and where we are communicating. Anyone want to help develop the ultimate online digital writer's CD-ROM disc? Mail me. ■

## mini-mikes



A German researcher from the Technical University of Darmstadt has designed a miniature silicon chip microphone the size of a pinhead. According to experts, the miniature mike could replace standard size microphones currently found in such devices as hearing aids, cassette recorders, telephones and camcorders. Since over 300 millions microphones are sold around the world annually, the potential market for the miniature mikes are anything but small fold.

In the early 1980s, researchers first developed a silicon chip microphone with a  $4\text{ mm}^2$  chemically treated silicon membrane by applying the same technology used to manufacture silicon chips. The miniature mike developed by Gerhard Sessler from the Technical University of Darmstadt works as well as standard size microphones and is capable of screening out background noises. Four times smaller than the first silicon microphones, moreover, the new mike is no larger than a pinhead.

By decreasing its 30 micron-thick silicon membrane to 15 microns, Sessler was able to develop a smaller prototype that he claims works at least as well as conventional microphones since vibration sensitivity, or the ability to detect sound, increases with thinner membranes. The smaller chemically treated membrane, moreover, also meets the needs of the different types of mikes currently on the market such as condenser, piezoelectric or optic-waveguide microphones.

The potential for the tiny mikes range from the hand-held camcorders or telephones to inconspicuous hearing aids. Concealed mikes used for police surveillance would be even easier to hide.

Sessler maintains that silicon mikes could be produced more efficiently and cheaply than conventional microphones. "They will replace conventional microphones just as the transistor has replaced the vacuum tube," says Sessler. With 600 million microphones reportedly sold around the world each year, "they are expected to catch a considerable share of the microphone market," he says. — BRUCE GAIN

HIS '60S SOUNDBITES PROVIDE THE WHITE NOISE HOVERING OVER HIS GLOBAL VILLAGE. SO UBIQUITOUS ARE THEY THAT ONE WONDERS WHETHER IT IS POSSIBLE TO REALLY UNDERSTAND MARSHALL McLUHAN. THIRTY YEARS AFTER HE PUBLISHED "UNDERSTANDING MEDIA" HE IS DUBBED THE ORACLE OF THE INFORMATION AGE AND PATRON SAINT OF THE CYBERZINES. BUT IS HE A FALSE GOD?

by Mark Dery

Illustration by Gregory Baldwin

"T

HE TRUTH SHALL SET YOU FREE," READS THE INSCRIPTION ON Marshall McLuhan's gravestone, written in the *Future Shock* computer typeface popular in the '60s. McLuhan died in 1980, but his truisms have indeed freed him, if only poetically. He lives on through his axioms, in advertising taglines, the forecasts of corporate futurists, and the received truths of cyberspace.

"Much of what McLuhan had to say makes a good deal more sense in 1994 than it did in 1964," writes Lewis Lapham, in his introduction to MIT Press' 30th anniversary reissue of McLuhan's seminal work, *Understanding Media: The Extensions of Man*. *Mondo 2000*'s tongue-in-chic *non sequiturs* cross McLuhan's aphorisms with *The Philosophy of Andy Warhol*, and its *User's Guide to the New Edge* features a full-page head-shot of the Canadian communications theorist, accompanied by a breathless eulogy ("This guy was way ahead of his time.") *Wired* has canonized McLuhan as its "Patron Saint." The magazine's 1993 premiere issue opened with a quote from McLuhan's collage book, *The Medium is the Message* (so titled because "all media work us over completely"), scrolling over eye-buzzing, neon-bright, digitized images: "electric technology... is reshaping and restructuring patterns of social interdependence and every aspect of our personal life." *Wired*'s invocations of McLuhan continue in its January 1995 issue, where the "mediologist" Regis Debray takes stock of McLuhan's intellectual legacy, and in its direct mail subscription campaign, which includes a scriptural flourish from the switched-on Gospel of McLuhan.

As McLuhan's resurrection makes clear, the cultural currency of the man Leslie Fiedler pronounced "two-thirds an absolutely fascinating analyst of society and culture and one-third mad" has yet to stabilize. In his widely-read essay on McLuhan, "What If He Is Right?," Tom Wolfe ventured, "Suppose he is what he sounds like – the most important thinker since Newton, Darwin, Freud,

Einstein and Pavlov?" Abbie Hoffman, John Lennon, and Susan Sontag championed his ideas; others, many of them academic colleagues, were less favorably disposed toward the

University of Toronto professor, who *Life* dubbed the "Oracle of the Electric Age." In *Marshall McLuhan: The Medium and the Messenger*, Philip Marchand notes that the "great majority of intellectuals and acad-

mics, it is safe to estimate, remained hostile to McLuhan," put off by his recondite prose style (remember, this was before French theory made impenetrability fashionable), his nonchalant attitude toward factual accuracy, and his seeming indifference to the political implications of his theories or to matters of social justice (McLuhan was more incensed by public littering than by the Vietnam War). Then, too, there was the ticklish business of his saturation exposure in the media and his often cosy relationship with Madison Avenue, perceived by many in the academy as evidence of his superficiality and venality (this was before Camille Paglia turned philosophy into a contact sport and William Burroughs shilled for Nike). McLuhan answered such charges with droll ripostes. "Some of my fellow academics are very hostile, but I sympathize with them," he told a *Maclean's* interviewer. "They've been asleep for 500 years, and they don't like anybody who comes along and stirs them up."

Renewed interest in McLuhan, catalyzed by the explosive growth of the Internet, a blizzard of white noise about the Information Superhighway, and the popularity of cyberzines such as *Wired* and *Mondo*, has revived the debate over his ultimate significance. To some, he remains the preeminent theoretician of the Information Age, the first public intellectual to proclaim that electronic technologies – specifically, TV, the effects of which were becoming manifest as the first TV generation came of age, and computers, whose influence was beginning to be felt in the corporate workplace and the automated plant – were transforming us into "post-Gutenbergian" beings, vertiginous selves eddying crazily around a "worldpool of information" (*The Medium is the Message*). To others, he is one more worse-for-wear relic in the time capsule of the '60s, a decade increasingly demonized by American conservatives as a breeding ground for Great Society social programs and "countercultural McGoverniks," to quote Newt Gingrich.

Before we consider McLuhan's relevance to our historical moment, let's review his greatest hits. To discover his fundamental insights, we must hack away his overgrown prose. His writing is a trackless thicket of jokes, Joycean puns, literary allusions, and cracker barrel anecdotes, at once digressive and maddeningly repetitive. It is this last quality that renders his basic theses unavoidable; formulated in the gnomic one-liners that have ensured him a postmodern half-life, they are driven home with a drumbeat insistence in his best-known works – *The Gutenberg Galaxy: The Making of Typographic Man* (1962), *Understanding Media*, and *The Medium is the Message* (1967), the million-selling *McLuhan Made Easy* paperback that eroded his reputation among the intelligentsia even as it secured it among the masses.

"SUPPOSE HE IS WHAT HE SOUNDS LIKE – THE  
MOST IMPORTANT THINKER SINCE NEWTON,  
DARWIN, FREUD, EINSTEIN AND PAVLOV?"  
— TOM WOLFE



Photo: Tim Douglas



- 22 ► "The public sphere is dead. Enter the anti-public sphere." WARK  
38 ► "The parallels between Joyce's 'nightmare' and the Internet  
are irresistible" TOFTS

THE MESSENDER

THE

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1971

Technological determinism is the keystone of McLuhan's theories. If Marx believed that class struggle was the engine of history, McLuhan held that the *engine* was the engine of history: he saw technological change – specifically, new forms of communication – as the prime mover behind human history. "Societies have always been shaped more by the nature of the media by which men communicate than by the content of the communication," he wrote. In other words, the medium is the message.

In *The Gutenberg Galaxy*, McLuhan juxtaposed preliterate, non-Western tribal man with Western "scribal man" (a product of pre-1500 "manuscript culture") and "typographic man" (an artifact of post-1500 "print culture") in a rambling, encyclopedic rumination on the cultural shock waves caused by the introduction of the phonetic alphabet and the printing press. Preliterate man, argued McLuhan, "lives in the implicit magical world of the resonant oral word" – a mythic dreamtime in which time and space are one, "an acoustic, horizonless, boundless, olfactory space" utterly unlike the rectilinear "visual space" configured by the Western, literate world-view.

A passionate convert to pre-Vatican II Roman Catholicism, McLuhan limned human history as a fall from grace: the phonetic alphabet was the forbidden fruit which condemned Western civilization to a postlapsarian world of isolation, objectivity, and rationality. His rendering of this event, in a 1969 *Playboy* interview, sounds unmistakably like Biblical allegory. The alphabet, he argued, "shattered the charmed circle and resonating magic of the tribal world, exploding man into an agglomeration of specialized and psychically impoverished individuals, or units, functioning in a world of linear time and Euclidean space." The invention of movable type (the first assembly line, in McLuhan's way of thinking) and shortly thereafter the portable book (which brought solitary reading to the masses), helped foster the world-view that structured Western consciousness

from the 15th through the 20th centuries. It crystallizes in the Enlightenment and attains its apotheosis in industrial modernity, where its insistence on linearity, compartmentalization, classification, detached observation, and a fixed point of view are dramatically evidenced in the Fordist assembly line, the "human engineering" of F.W. Taylor, and the panoptical design of the Machine Age factory, office, and asylum.

In *Understanding Media*, McLuhan announced that the Information Age – ushered in, for his purposes, by the invention of the telegraph in 1844 – reversed the course of history. "After 3000 years of explosion, by means of fragmentary and mechanical technologies, the Western world is imploding," he wrote. By this, he meant that

**"WE ARE FAR MORE DEEPLY EN-MESHED WITH EACH OTHER AS INHABITANTS OF THIS PLANET THAN EVER BEFORE, AS A RESULT OF THE MEDIA MCLUHAN WAS DISCUSSING, BUT... THAT DOESN'T MEAN THE HUMAN CONDITION HAS BECOME ROSIER."**

— HOWARD RHEINGOLD



Photo: Jon Hamilton



the hyperaccelerated, nonlinear nature of electronic media was "demesmerizing" Western culture, snapping it out of the "typographic trance" into which the printing press had thrown it. Cybernetic culture, quoth McLuhan, returns us to the preliterate world-view – mythic rather than rational, tactile rather than visual, integrated rather than atomized. Electronic interconnectedness has transformed our wired world into a "global village" in which our lives are inextricably intertwined with each others' and with the larger drama of our culture, even our planet. "Ours is a brand-new world of alltoneness," he wrote, in *The Medium is the Massage*. "'Time' has ceased, 'space' has vanished.... We are back in acoustic space. We have begun again to structure the primordial feeling, the tribal emotions from which a few centuries of literacy divorced us."

The notion of a "global village" – the concept that, more than any of McLuhan's ideas, is reflexively invoked throughout '90s cyberspace – offers a springboard for our critique of McLuhan. It is a commonplace that the global village is upon us, made possible by computer networks, fax machines, satellite hookups, videoconferencing, and of course the telephone. But has telecommunications truly realized McLuhan's vision? Certainly, the instantaneousness of communications technologies has collapsed the distances between cultures, literally as well as figuratively. But what makes McLuhan's global village a village is not so much the interactivity enabled by its virtual commons, as the sense of profound involvement that supposedly flows from our electronic interconnectedness. "In the electric age," he asserted in *Understanding Media*, "we necessarily participate, in depth, in the consequences of our every action... the electric implosion... compels commitment and participation."

TV's role in galvanizing opposition to the Vietnam War or, more recently, in mobilizing humanitarian aid for starving Somalis, would seem to bear this out. Then again, the curious inertia of an international community awash, nightly, in graphic images of butchery in Bosnia-Herzegovina or Rwanda would seem to suggest that "commitment and participation" do not spring spontaneously from our electronic window on the world. Absent social consciousness and, more importantly, political will on the part of the global community, the wires that connect us are not ties that bind, merely plumbing for a deluge of images that initially jolts us, soon numbs us, and ultimately bores us. "Social service organizations and their donors complain about 'compassion fatigue,'" notes Randall K. Bush. "Not only have we seen the starving children... before, but we have also donated to relief efforts after such events before.... We switch channels to something else" ("Not Global Villagers, but Global Voyeurs," *The Christian Century*, September 9-16, 1992). On an uglier note, the peace movement that sprang from the living room horrors of history's first TV war must be weighed against the troglodytic chest-thumping that greeted images of Iraqis barbecued alive on the Basra highway in history's first Nintendo war.

Of course TV, we are told, is an outmoded, top-down, one-way medium; virtual communities, with their inherently democratic structure, are more likely candidates for McLuhan's global commons. Or are they?

50 ► "Space...as the history of humanity knows it, is a space on the way to disappearance." VIRILIO



"At first I thought this was Marshall McLuhan's global village coming to reality," said Neil Harris, a manager at [a company] which sets up computer conferences and sells information to about 200,000 members around the world. "But it's not that at all. It's a lot of people connecting in hundreds of small communities based around highly specific interests." (John Markoff, "Locking the Doors in the Electronic Global Village," *The New York Times*, July 28, 1991). Jeff Salomon, writing in *The Village Voice*, agrees: "Contrary to grand predictions that the Internet would open up our world, it has mostly offered people the opportunity to pack themselves into ever smaller worlds, where enthusiasms mutate into obsessions, and a reality check is a parallel dimension away" ("Revenge of the Fanboys," September 13, 1994).

"We are far more deeply enmeshed with each other as inhabitants of this planet than ever before, as a result of the media McLuhan was discussing," argues Howard Rheingold, author of *The Virtual Community*. "But... that doesn't mean the human condition has become rosier. We're all in on the action in Bosnia, but we can't do anything about it. The Internet, on the other hand, is important not so much for any of the truly remarkable uses it has been put to thus far, but for the way it redistributes the power to disseminate as well as absorb communication. I think you are correct to point at the atomization of interests as a disintegrative effect of the same technology that brings integration at other levels. We do connect across all kinds of boundaries. But we all pull the fabric apart in pursuit of our interests. It's a version of... the tragedy of the commons. Humans are social beings; modern citizens are individuals."

Ironically, the secession from the meatworld speaks partly to a widespread desire to reclaim the notion of community – a notion rendered increasingly obsolete by the racial, economic and political tensions that are balkanizing American culture, and by the very electronic media McLuhan believed would knit us together. The social and psychic integration he contended would result from communications technologies is belied by the fragmentation of on-line society into atomic "special interests" and by the terminal anomie (pun intended) that results from lives lived, more and more, in the electronic spaces of TV, videos, movies, computer games, BBSs, MUDs, and so forth. McLuhan's "complex and depth-structured" homocysterneticus, "emotionally aware of his total interdependence with the rest of human society," can be found in the on-line Samaritans who leapt to the aid of the Cornell University student who posted an electronic suicide note, or in Amnesty International's dream of establishing a human rights network on the Internet, but these are the exceptions that prove Ballard's Rule.

In his keenly insightful introduction to the French edition of his SF novel *Crash*, J.G. Ballard identified "the most terrifying casualty of the century: the death of affect," and linked the 'demise of feeling and emotion' to "the preempting of any free or original imaginative response to experience by the television screen." Those who see the virtual community (VC) as an electronic agora, restoring a sense of community and reviving public discourse in the age of the corporate media monopoly, will protest that VCs are not TV; so noted. But the bright promise held

forth by VCs must be considered in the context of the culture at large, where (in America, at least) the flight into cyberspace takes place at a time when urban public space, as Mike Davis argues in *City of Quartz*, is increasingly privatized and segregated in the name of "redevelopment"; when working-class urbanites fortify what Davis calls their "prison cell houses" with bars and grates while middle-class suburbanites retreat into privately policed gated communities; when the fear of crime and a chimerical drug war are used to justify the whittling away of civil liberties; and when U.S. Secretary of Labor Robert B. Reich warns of the "secession of the rich" – the abdication of social responsibility by an Information Age elite "linked by jet, modem, fax, satellite and fiber-optic cable to the great commercial and recreational centers of the world, but... not particularly connected to the rest of the nation" ("Secession of the Successful," *The New York Times*, January 20, 1991).

In such a context, virtual communitarianism that does not bear fruit in the meatworld, as a result of on-line grassroots organizing, entrepreneurial initiatives, information exchange, consciousness-raising, and so forth, cedes the TERRITORY of the real to the powers that be and escapes to a kinder, gentler place by rolling itself up in the MAP. It is indistinguishable, in all the essentials, from TV escapism

Thus, the global village has arrived, but it bears only a passing resemblance to McLuhan's Paradise Retribalized. He was wide of the mark in his contention that "electric technology has meant for Western man a considerable drop in the visual component in his experience" (*The Medium is the Message*). Western culture in the late 20th century, when we spend more and more of our lives staring at video monitors or computer terminals, is utterly dominated by "the visual component." McLuhan was resoundingly wrong, as well, in his flabbergasting assertion that TV, universally regarded as a heat lamp for couch potatoes, "demands participation and involvement in depth of the whole being" and would therefore sound the death knell for "the consumer phase of American culture." (McLuhan's analysis was based on his pseudoscientific theory that the technical nature of the TV image, composed of innumerable dots, requires the viewer's "convulsive sensuous participation" to "close" the spaces in the mesh, making the picture coherent [*Understanding Media*]. It was wrong in his day – there is nothing sensuous or participatory about an automatic, unconscious visual mechanism – and it is doubly wrong now, when the quality of the TV image has improved many times over.)

Finally, instead of McLuhan's "depth-structured" global citizens, we witness the rise of depthless individuals whose fundamental empathy, let alone their sense of social respon-

**J.G. BALLARD IDENTIFIED "THE MOST TERRIFYING CASUALTY OF THE CENTURY: THE DEATH OF AFFECT," AND LINKED THE "DEMISE OF FEELING AND EMOTION" TO "THE PREEMPTING OF ANY FREE OR ORIGINAL IMAGINATIVE RESPONSE TO EXPERIENCE BY THE TELEVISION SCREEN."**



Photo: Jerry Bauer





sibility, has been seriously diminished. Obviously, this diminution is largely the product of social, economic, political, and sometimes psychological factors, but it is aided and abetted by the electronic media that disengage us from "the consequences of [our] every action." Again, the Nintendo War is a case in point. U.S. Marine Lieutenant Colonel Dick White, interviewed upon returning from a Gulf War bombing run, enthused, "It was like turning on the kitchen light late at night and the cockroaches started scurrying.... We finally got them out where we could find them and kill them" (Robert Fisk, "Free to Report What We're Told," *The Independent*, February 4, 1991). A god's-eye perspective, high over Iraq, and the unreality that sets in after long immersion in the screens of a hi-tech cockpit, turned bombing runs into video games. And as the tagline in a Nintendo TV spot ran, "Once you start playing, nothing else matters."

The profanity of such images stands in stark contrast to McLuhan's sublime vision, in the *Playboy* interview, of a global village "in which the human tribe can become truly one family and man's consciousness can be freed from the shackles of mechanical culture and enabled to roam the cosmos." Nonetheless, as noted earlier, we are habitually told – often by advertisers and laissez-faire futurists – that we are living in a global village. And, in a sense that would have horrified McLuhan, we are: the viral infestation of international markets by McDonald's, Coca-Cola, Levi's, pop music, and Hollywood blockbusters is creating what *Fortune* has called a "one-world pop-tech civilization."

But advertisers and futurists are not the only ones who celebrate the global village. Perhaps because, rather than in spite of, the disparity between our turbulent present and McLuhan's luminous future, his ideas cast a powerful spell on fringe computer culture, where they have acquired a New Age aura. By the late '60s, McLuhan's concept of the global village had evolved into a techno-mystical vision of the "Psychic communal integration, made possible at last by the electronic media," of all humankind. This planetary cosmic consciousness is not unlike the evolutionary epiphany foretold by Pierre Teilhard de Chardin, who proclaimed the coming of an "Ultra-Humanity" destined to converge, ultimately, in an "Omega Point" – a

"cosmic Christ" who is the "consummation of the evolutionary process." In the '90s, ravers, zippies, and other members of cyberdelic culture have overlaid these ideas with a New Age eschatology that sees the wiring of the world as "the final stage in the development of Gaia," to quote the Deadhead technophile Douglas Rushkoff. Jody Radzik, identified in a *Rolling Stone* feature on smart drugs and rave culture as "one of the [rave] crowd's resident gurus," believes that "the planet is waking up.... Humans are the brain cells. The axons of the nerve cells are the telephone lines." (Gary Wolf, "Don't Get Wasted, Get Smart," *Rolling Stone*, September, 1991)

**"I BELIEVE THAT THE INTERNET IS  
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PLANET AND EVERY OTHER."**

— JOHN PERRY BARLOW



John Perry Barlow, who often cites Teilhard de Chardin and who calls McLuhan "a meta-touchstone for all of my thoughts on media, information, and mind," asserts that "we are engaged in a Great Work, the creation of the Collective Organism of Mind on a global scale.... I believe that the Internet is creating a new neurosystem which will ultimately interpose itself continuously between every human synapse on the planet and every other. 'Thoughts' are already arising in this meta-organism which are dimly perceptible to us. They will become more perceptible even as our 'own' thoughts gradually disappear into the whole."

The retrofitting of McLuhan's theories, by Barlow and others in cyberdelic culture, is less misguided than it appears, at first glance. On closer inspection, it sheds light on McLuhan's deeper meaning. His quest to create an exact science of media criticism (his last, posthumous book was titled *Laws of Media: The New Science*) founded on his confusingly counter-intuitive terminology (TV is a "cool" medium, the book a "hot" one) and his corkscrew reasoning (he once described a nuclear explosion as "information," and asserted that the "German Jew [was] victimized by the Nazis because his old tribalism clashed with their new tribalism"). Even so, he wrapped himself in the mantle of the objective scientific observer, insisting in the *Playboy* interview that as "an investigator, I have no fixed point of view, no commitment to any theory – my own or anyone else's." Later in the same interview, however, the mantle slips: he views the "upheavals" caused by the electric age, he says, "with total personal dislike and dissatisfaction." His "retribalized" technoculture, it turns out, is the sort of quietly reactionary utopia that would have gladdened the heart of one of his major influences, the Catholic intellectual G.K. Chesterton: characterized by "little radical social change," it is "essentially conservative" in nature. In *Media and the American Mind: From Morse to McLuhan*, Daniel J. Czitrom contends that "McLuhan expressed a personal variant of the Tory, neo-Catholic, anti-modern tradition flourishing on both sides of the Atlantic." In a supreme irony, the Oracle of the Electric Age turns out to be a recovering Luddite and a closet Rousseauite, ill-suited to his office as the patron saint of *Wired*, a "future-friendly" magazine that celebrates the "revolutionizing [of] the old order" through technological change (*Wired*, 3.01).

McLuhan's unexpected resurrection, just in time for the millennium, finds him in a strange, new incarnation. He appears, in fringe computer culture, as the patron saint of the jacked-in noosphere – the first theologian of information, a postmodern heir to his intellectual mentor, St Thomas Aquinas. (His theory of communications, insisted McLuhan, was "Thomistic to the core.") Among the secular, his lasting contribution to our understanding of the world remains the revelatory thunderbolt that our technological environment shapes our world-view – that the medium is the message. But for those who believe they are neurons in an emergent global meta-mind, he is the medium's messenger. ■





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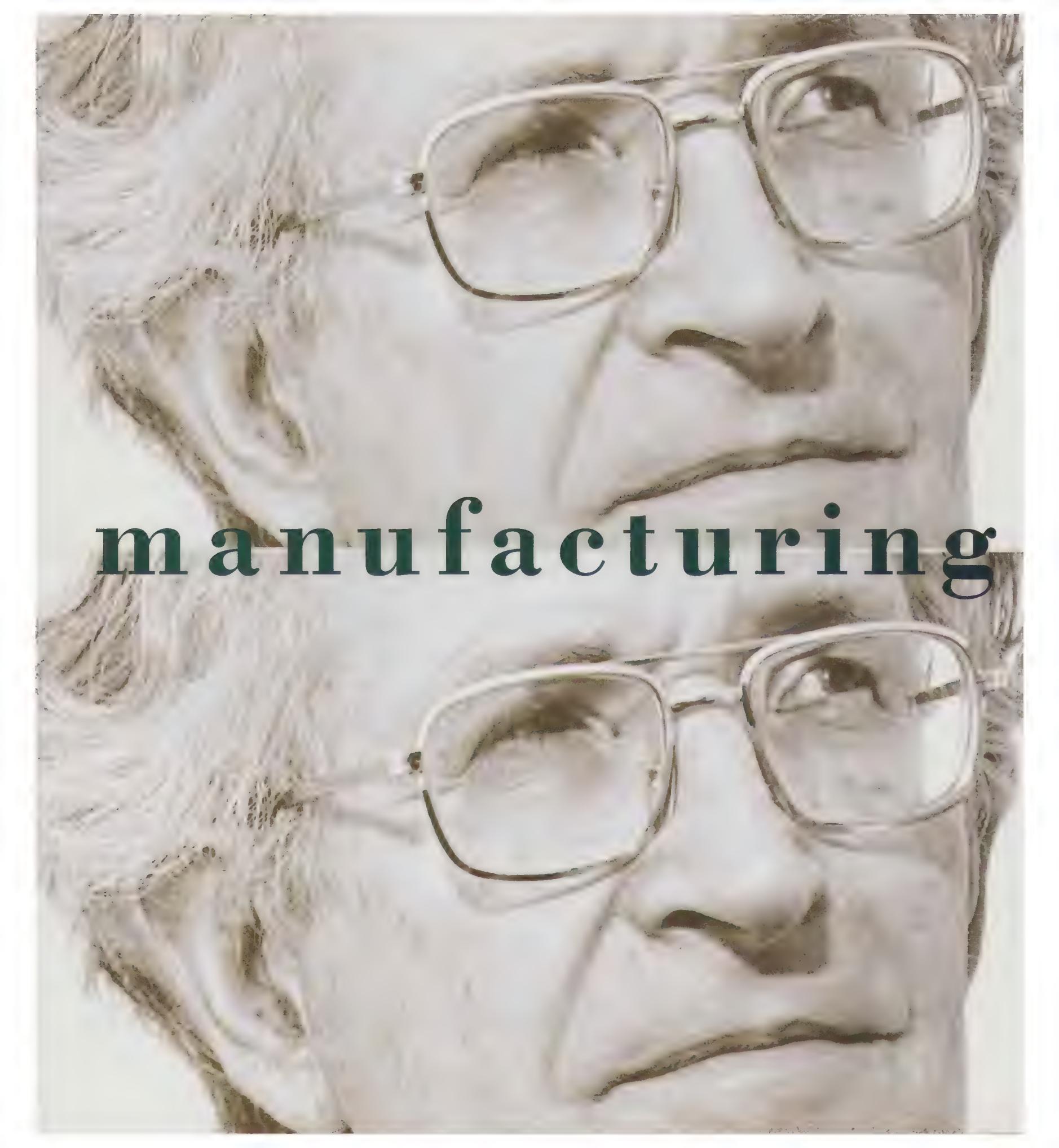
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NOAM CHOMSKY IS BOTH THE MOST FAMOUS LINGUIST ALIVE AND THE MOST NOTORIOUS DISSIDENT IN AMERICA. WITH A 40-YEAR CAREER OF POLITICAL ACTIVISM AND SCRUTINIZING THE MEDIA, HIS VIEWS OF TECHNOLOGICAL COMMUNICATION ARE FAR FROM IDEALISTIC.

by Catharine Lumby

Photograph by John Collings

**N**OAM CHOMSKY HAS BEEN A SHARP THORN IN THE United States' side since the 1960s when he began speaking out against its involvement in Vietnam. In a country where the middle political ground is highly conservative, it is hardly surprising to see the 67-year-old professor of linguistics, who describes his political leanings as variously anarchist or libertarian socialist, under attack from the establishment.

Yet, some of the sharpest responses to his views on power relations between the state, the media and the intellectual elite have come from fellow intellectuals on the Left. Michel Foucault, who, despite his association with Leftist causes, also had a difficult relationship with the institutional Left, once took Chomsky to task in a television debate for the humanism which underlies his notions of justice and freedom. Media theorists are also notoriously wary of the sweeping pronouncements Chomsky makes on the role of the media.

But if he has no shortage of intellectual critics on both ends of the political spectrum, Chomsky's tireless activism and commitment to grassroots political causes has also earned him devout supporters.

Despite his early embrace of the Left, Chomsky has never joined a political party. While often described as a libertarian socialist, he is best defined as a dissenter. "I'm not much of a joiner," he says. His path through the academy was similarly singular. His ground-breaking book, *Syntactic Structures*, published in 1957, rejected the traditional empiricist view that language is learned as a habit; Chomsky argued that human beings are born programmed to learn language – that the mind contains an innate universal grammar. This genetically determined blueprint means that every child 'knows' the principles of language before he or she utters a word. His work spawned a new school in linguistics.

But with a ground-breaking career ahead of him, and a

# dissent

FROM NICARAGUA TO TIMOR THE NET IS BEING USED BY RESISTANCE GROUPS TO SEND MESSAGES OUT TO DICTATORS AND DISSIDENTS ALIKE. NOAM CHOMSKY DISCUSSES THE BENEFITS OF THE NET, THE DEATHKNELL OF LEFT PUBLICATIONS, AND THE REDUNDANCY OF CRYPTOGRAPHY.

by Rosie Cross and Chris Mountford

Digital Imaging by Gus Collings

**H**ow do you perceive the present influence of technology – primarily, low-cost PCs and global public information networks, the technology of the so-called information revolution – on the mass media's power in the future?

**Chomsky:** It's double-edged. You can already see the competing/conflicting tendencies developing. Up until now it's been pretty much a monopoly of relatively privileged sectors, people who have access to computers in universities and so on. In the academic world it's turned out to be a very useful way of communicating scientific results, but in the area we are talking about it has been used, pretty efficiently in fact, for distributing information and setting up interconnections.

In the U.S. and Europe, Peacenet puts across tons of information. There are specialist bulletin boards where groups with particular interests and concerns interact and discuss all sorts of things. The main journal that I write for is Z magazine, an

independent Left journal. They have a Z bulletin board which lefty types subscribe to.

So on some issues, like East Timor, it's been invaluable for organization. The reason for that is most of the information about it isn't in the mainstream. Other issues have come to the fore, which is all a positive consequence of the technology.

The major negative is that I notice a lot of people, including committed activists, are dropping their subscriptions to Left journals and their commitment to Left institutions because they can get it free. Now that's a pretty surprising position for someone on the Left to take, but it's common. It shows how much market distortions have entered into the consciousness of people who ought to know better, because the long-term effect of this will be to destroy the independent institutions. It could go all sorts of ways, I am really talking here about the downside, and really the dedicated Left activist should know better.

## **Looking to the future of the Net and television in a multichannel environment, Chomsky suggests private ownership may sidetrack public participation.**

professorship at the Massachusetts Institute of Technology, Chomsky decided to go public with his political views. In 1966 he published "The Responsibility of Intellectuals" in *The New York Review of Books*, in which he described the Vietnam War as a "savage American assault on a largely helpless rural population in Vietnam."

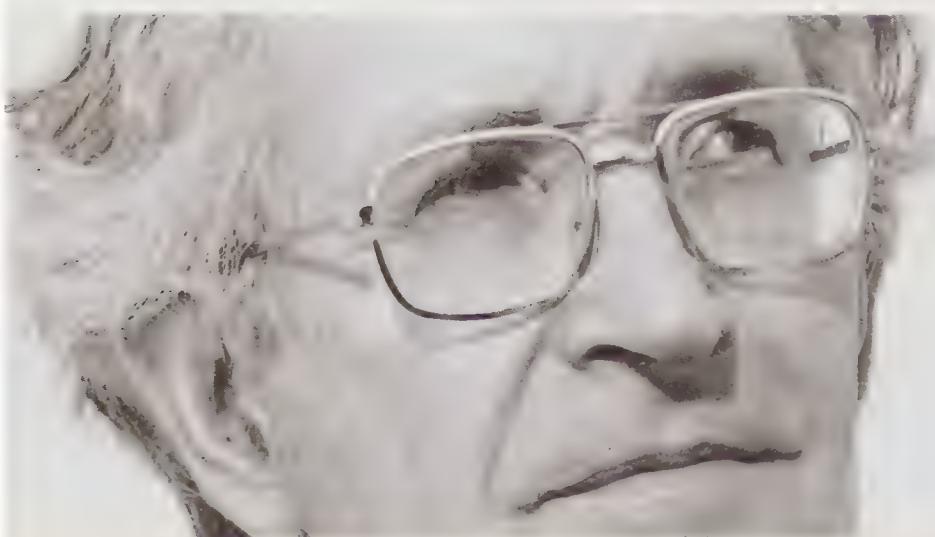
In the intervening three decades, Chomsky has thrown his weight behind countless issues, but none illustrates his political focus and the ideas which underpin it better than his campaign to expose the Indonesian invasion of East Timor.

In books, lectures and discussions, Chomsky has repeatedly contrasted Western media coverage of the aftermath of the Khmer Rouge regime's rule in Cambodia with coverage of events in Timor. Chomsky commented recently: "The great act of genocide in the modern period is Pol Pot, 1975 through 1978.... I think it would be hard to find any example of a comparable outrage and outpouring of fury and so on. So that's one

atrocity. Well, it just happens that in that case, history did set up a controlled experiment." The "controlled experiment" was the apparent media blackout on Indonesian aggression in Timor during a time when thousands of column inches were being devoted to Pol Pot. Chomsky comments: "This is way beyond just demonstrating the subservience of the media to power. They have real complicity in genocide in this case. The reason that the atrocities can go on is that nobody knows about them.... So therefore by suppressing the facts, the media are making a major contribution to probably the worst act of genocide since the Holocaust."

Chomsky's hardline stance on the media's role here is indicative of what critics claim is his persistent oversimplification of power relations. Where journalists see chaos, deadline pressure and conflicting commercial and editorial concerns, Chomsky sees a "system of ideological control." He cites the U.S. media's coverage of the recent congressional elections as evidence. The Republican "landslide" he describes as "part of the media scam – the landslide is completely fabricated."

Chomsky's view of power relations in late capitalism, and the potential for resistance, is essentially a simple model. Power is held at the top of a hegemonic system in tacit collusion between the state, the private sector and the intellectual elite. The media, in this world, add up to little more than propaganda merchants. The only ray of light in Chomsky's



*You have voiced a concern over the amount of junk e-mail being sent, but although it's easy to send out half-baked ideas, on the Net, it's also easy to avoid them – scroll, speed read... use the machine to wade through it.*

I have a compulsion to respond to it. It's almost neurotic with me, it doesn't seem proper to not respond or react to a communication. But it's such a burden that I have decided to not answer most of it.

*Do you as a linguist get annoyed at the slipshod way people present ideas on the Net or how they choose to compose personal communications with you?*

Linguistics has absolutely nothing to say about this sort of thing, nor does science in general. Science, including linguistics, deals with very simple problems. It rarely touches on any

question of human concern, and one shouldn't create illusions about this. Anything that's understood about the social and political world, the world of human relations, is available to anybody who stops to think about it.

*But we have seen many norms established on the Net, and been told how to behave, what to say and how to say it, especially by academics. Can you explain exactly what you mean by a half-baked idea?*

Simply an odd idea which occurs to you. There are two ways to deal with it, one is to think about it, organize it, put it down on paper, I don't mean fancy talk, but just think through what you had in mind – see if it makes any sense. That's what people tend to do when they are writing something. On the other hand, if you have a half-baked idea and meet a friend waiting for a bus, you may say how about so-and-so, and you don't bother thinking about it. Well e-mail has something of that character. I'm not saying that as a linguist – a 12 year old could make the same comment without any academic experience.

The big effect which I still haven't mentioned, and the one that worries me most, is what the corporate world is telling us they have in mind. What they have in mind is taking the whole thing over and using it as a technique of domination and control. If I were a P.R. guy working for Warner Communications that's just what I'd be working on. Those guys have billions of dollars that they can put into this, and the whole technology,

world view is offered by resistance from outside the structures which perpetuate power. He believes that if "you read the media with sufficient cynicism and criticism, and you read it broadly enough, and you understand what's going on, if you understand there's an intensive effort to make you see things in a particular way, then you can resist."

If Chomsky sees an implicit collusion between the media and power – a thesis he's pursued for many years – how does he perceive the Internet, a medium often thought to be classless, unregulated and democratic? And what of the advent of a multichannel environment in the U.S., in terms of Chomsky's thesis?

While acknowledging the forum the Net provides for setting up resistance groups and communicating vital information quickly, he remains pessimistic about its long-term potential.

Asked recently at a launch for 21•C whether computer hackers are the 21st century freedom fighters, Chomsky joked "that's a bit close to home. My son is a hacker." Despite reservations expressed during our interview, he keeps in touch with the screen. "Groups like the East Timor Action Network in the U.S. are very heavily Internet-based. But the Internet is pretty much an elite operation – ordinary people don't have Internet connections. Plus an awful lot of what goes over the Internet is just gossip." Chomsky, not surprisingly, has little time for gossip.

The Information Superhighway may be a new phenomenon, he says, but the debate surrounding it has similarities with previous media technologies. Looking to the future of the Net and television in a multichannel environment, Chomsky suggests private ownership may sidetrack public participation. He compares the situation to the fate of radio in the 1920s and network television in the '50s. "In every country a struggle went on over the control of them," he says. "When radio came along in the 1920s it was immediately obvious that it was going to have to be regulated. And the question is; who's going to control it? Is it going to be controlled by the public, which means through the government? Or will it be commercial tyranny – pure tyranny – run by commercial institutions? In the U.S. it essentially became close to 100 per cent privatized. When television came along, the same was true."

Chomsky believes the potential in new media forms will be strangled by the same interests. "Bill Gates' plan for interactivity is to make people stupid. Subordinate them to technology by way of interactive shopping."

"They want to turn the Internet into a shopping system primarily," he says. "Into a system of forcing submission. I read one article in which they described the great prospects in which they said 'For women we'll have home shopping where you have interactive technology.' It'll be interactive because a model will appear on the screen holding something that

**"Bill Gates' plan for interactivity is to make people stupid. Subordinate them to technology by way of interactive shopping."**

including the Internet, can go in this direction or it can go any other direction.

*It's become popular to fraternize or be associated with subversive or alternative political groups. Even the middle class now claims their computer-based info-tech activities to be 'anarchic,' not only in structure but assuming a 'lifestyle' of underground activist, cyberpunks punching their way to freedom. Is there an unintentional effect occurring due to this appropriation of info-tech culture?*

All sorts of good things are happening unintentionally. I mentioned several in terms of the interactions it's setting up. I have a daughter in Nicaragua, and Nicaragua in the '80s was under a complete ban, you couldn't get a letter down there. But we were communicating thanks to the Pentagon. Thanks to the Pentagon and the fact that I'm at MIT, I was on the ARPANET, and it's not meant for people like me, but they can't get me out, and so my daughter, who had a connection, and I, during the terrorist war, were actually communicating thanks to the Pentagon.

#### **Did you or do you use cryptography?**

I just don't care about secrecy. One thing I have learnt over the years in resistance, and having been close to long jail sentences and been in trials, I know this system pretty well, and the one thing I've discovered is to be completely public. The intelligence

systems are so ideologically fanatic that they cannot understand public opposition. They assume that everybody is as nutty as they are and so they spend all their time and energy trying to figure out the connections to North Korea or something like that. The idea that someone could honestly and openly say 'I defy the Government, I reject what you're doing, I'm going to subvert it' and so on, they simply dismiss. The safest thing is to be quite public. There is no way to protect yourself from the National Security Administration snooping, but they don't bother, they don't have the resources, and if they had they couldn't do anything with them because they are too stupid to use the information.

*Unlike broadcast media this is not one-to-many, but any-to-any, it can be one-on-one or one-to-a-very-large-audience.*

The public nets, where everyone is talking to one another have, in my opinion, the same degraded character as the individual e-mail messages; people are just too casual in what comes across. You often get good things, but buried. I know with people, even friends, that the quality of what they are doing is declining because of their intense involvement in these e-mail interactions which have such an overwhelming character when you get involved in them. It's seductive, people get seduced by the computer and sitting there banging around at it. It has a negative potential and a certain positive potential, but it's a double-edged sword.



nobody wants but you'll feel you have to have it, so you push a button and it gets delivered. For men, it'll be interactive because men will be watching the superbowl and when the quarterback asks the coach what the next play's going to be you say what you think the play ought to be and after the play you can push buttons and find out what everybody thought."

According to Chomsky, "You can liberate people with technology, but as in the case of automation, it can de-skill or empower. Most people, like hackers for instance, eventually subordinate themselves to power, like academics or journalists." The number of convicted hackers now working for the computer industries they once tried to subvert, supports Chomsky's thesis. Coincidentally, Bill Gates uses Henry Ford as an abject lesson in power. Where Chomsky perceives Fordism as the harbinger of the deskilled worker, Gates sees Ford as a symbol of complacency, a man who had a monopoly and relinquished it.

The Professor admits "I get all of my information on the Information Superhighway from the *Wall Street Journal*" which he perceives as a reliable source as its coverage is driven by market forces. He admires its honesty "It doesn't pretend to be anything other than the journal for the financial community."

For someone who professes continual faith in the ability of 'ordinary' people to understand and act on the world, Chomsky also entertains some classically elitist intellectual notions about mass culture. He dismisses everyday pleasures as a

"fantasy world." The main aim of most popular culture, he believes, is to divert people from things that matter. "To get them to watch the National Football League. And to worry about 'Mother With Child With Six Heads,' or whatever you pick up on the supermarket stands. Or look at astrology.... Just get them away from things that matter. And for that, it's important to reduce their capacity to think." It's a view which apparently consigns Chomsky to the ivory tower he so desperately wants to climb down from. Ordinary people apparently still need intellectuals to enlighten them and organize their spare time.

For all his research into the media, Chomsky exhibits little interest in the formal properties of television as a medium and the structural consequences for the way we view our world. Good television, in Chomsky's view, is television as a transparent container of worthy information. There is no sense that, as McKenzie Wark, author of *Virtual Geography*, says, "Popular culture is the medium through which politics connects to the everyday life of ordinary people. It's arrogant of intellectuals to think of people as cultural duds. Given the right resources, people are quite capable of interpreting news and current affairs in the light of their own experience. Most people seem quite aware that television creates a quite peculiar political space – it can never be a transparent reflection of reality. It's about stories. The trouble is that intellectuals like Chomsky think everyone should always view the world the way they do." ■

## The Pentagon is not going to give people as a gift a technique for free communication which undermines the major media; if it's going that way it will be because of struggle, like any other victory for freedom.

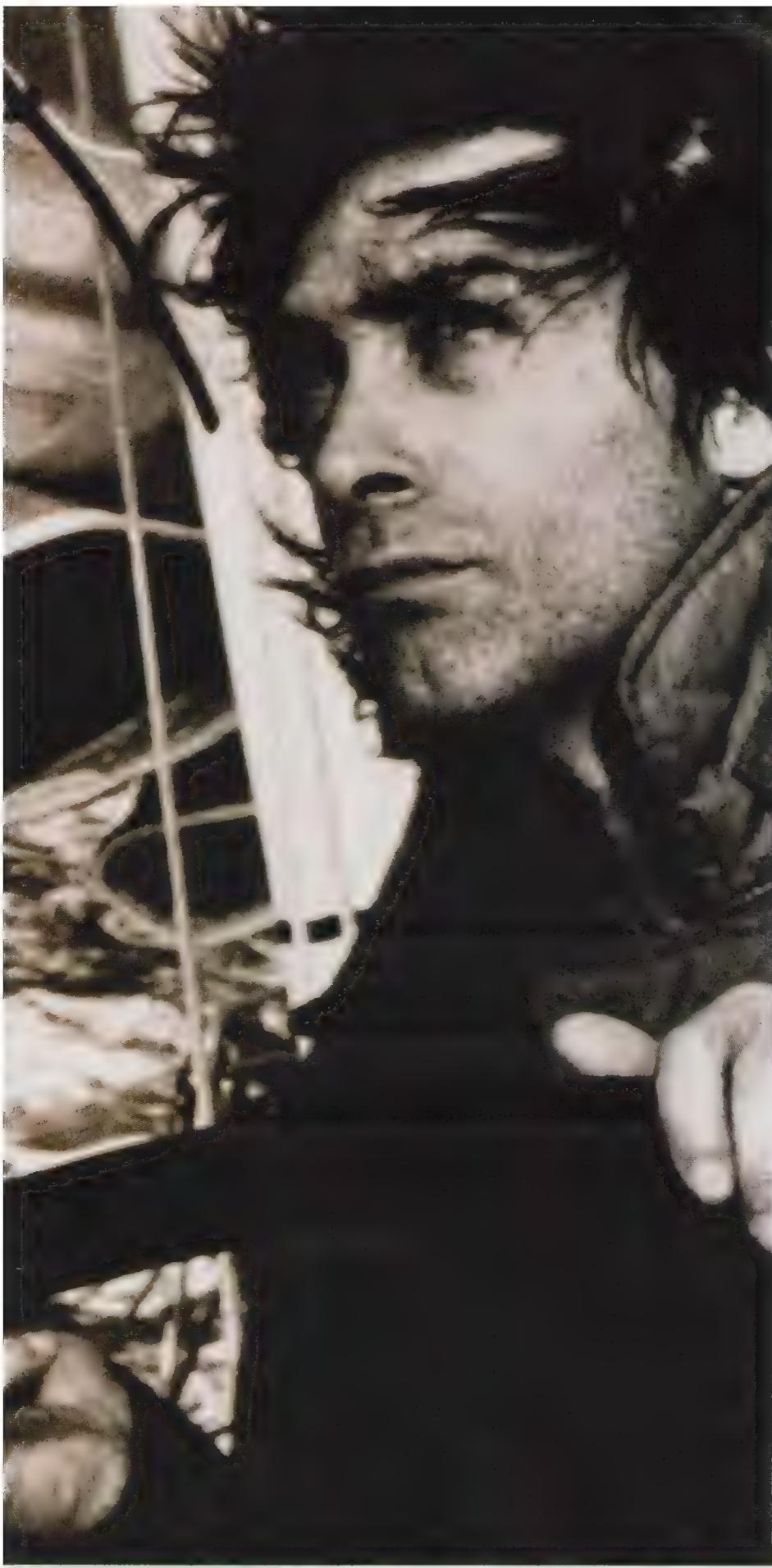
The way the technology is likely to go is unpredictable. If I had to make a guess, my guess is corporate take-over. To the extent that it's so far tax-payer supported, and it's a government institution, in fact it's a military system at base and they are letting it go, and the reason they are letting it go is because they are not concerned about the positive effects it has. They probably feel, maybe correctly, that it's overwhelmed by the negative effects. These are things people have to achieve, they are not going to be given as gifts. The Pentagon is not going to give people as a gift a technique for free communication which undermines the major media; if it's going that way it will be because of struggle, like any other victory for freedom.

*Do you think that the technology is inherently democratic?*

There is no technology which is inherently democratic, and no technology which is inherently oppressive for that matter. Technology is usually a fairly neutral thing. The technology doesn't care really whether its used for oppression or liberation, it's how people use it.

*You mentioned people leaving their subscriptions behind, could that become all electronic?*

The threat to Left institutions is severe in my opinion. If people become so anti-social and so controlled by market ideology, that even people on the Left will drop their support for independent Left media institutions because they can get something free, those institutions will decline and they won't be anything over the Internet. As what goes over the Net now are things that come out of the existing institutions, if those are destroyed nothing is going to come out that counts. ■



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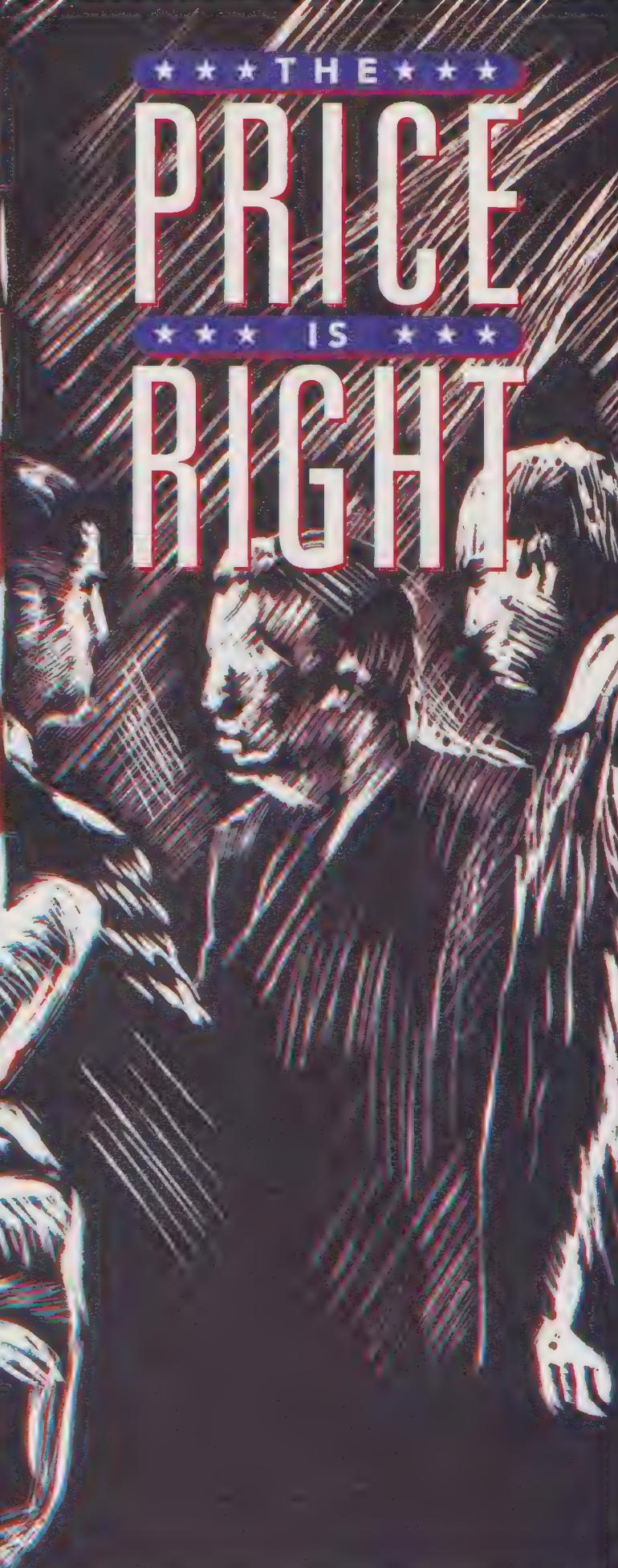
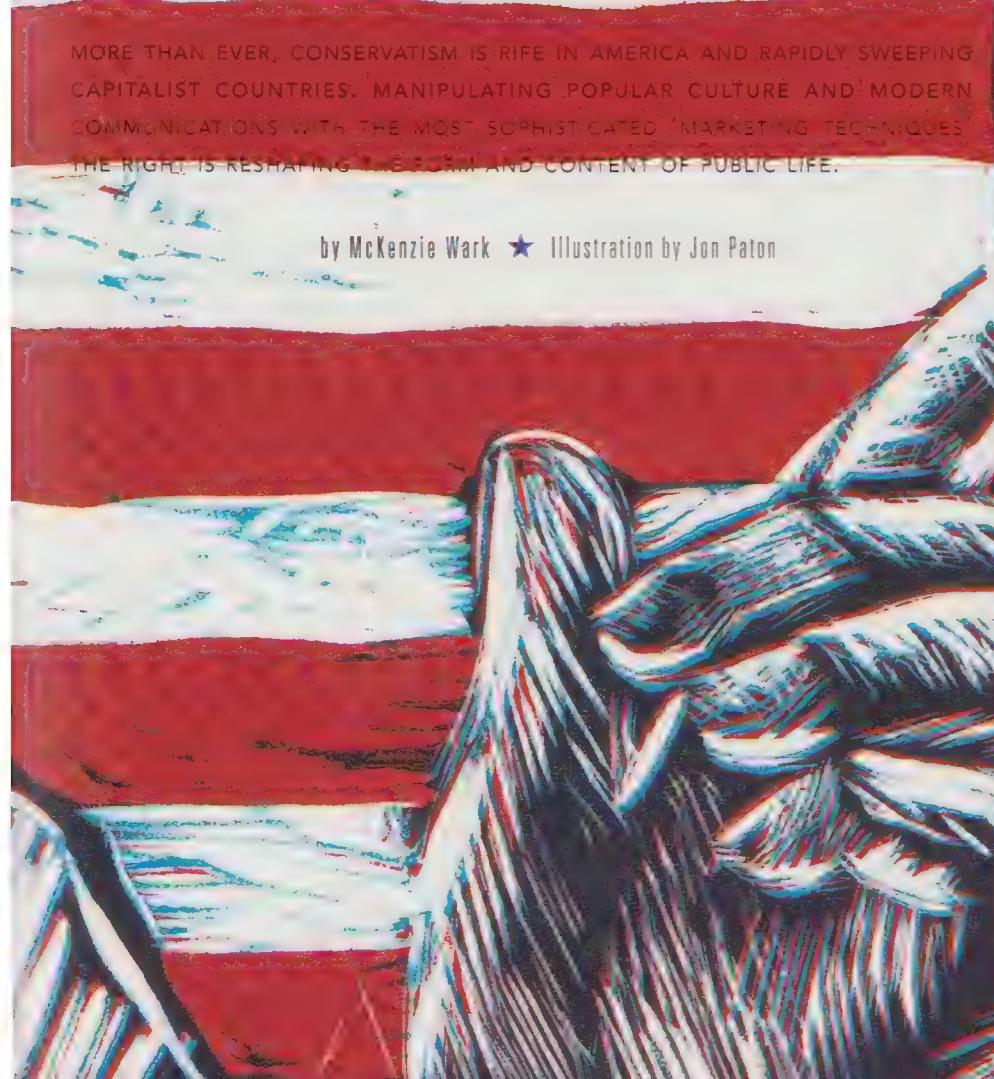


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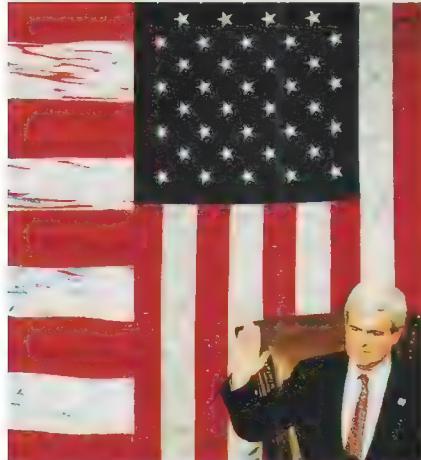
# PRICE IS RIGHT

MORE THAN EVER, CONSERVATISM IS RIFE IN AMERICA AND RAPIDLY SWEEPING CAPITALIST COUNTRIES, MANIPULATING POPULAR CULTURE AND MODERN COMMUNICATIONS WITH THE MOST SOPHISTICATED 'MARKETING TECHNIQUES'. THE RIGHT IS RESHAPING THE FORM AND CONTENT OF PUBLIC LIFE.

by McKenzie Wark ★ Illustration by Jon Paton



**The Shock of the Newt:**  
Republican senator Newt Gingrich has been particularly resourceful in commandeering communications and is perhaps the most ideologically convincing of the new post-Cold War neo-con warriors.



**Limbaugh to the Right:**  
Radio and cable TV talk host Rush Limbaugh is the best known of a network of neo-con hosts across the U.S. who form an important part of the anti-public sphere's alternative to the mainstream press and TV networks, which the hard-core Right regard as far too liberal-lefty to be of use.

**T**HE PUBLIC SPHERE IS DEAD. ENTER THE ANTI-PUBLIC sphere. Privately funded, more in tune to a restricted range of corporate interests, the anti-public sphere is reviving some very old, far-Right ideas, but it is also incubating some weird new strains of its own.

The sea change in American politics late last year signals more than a shift to the Right. It is the rise to power of the anti-public sphere – a powerful network of conservative thinktanks, foundations, media outlets, and intellectual activists who have bypassed the old channels of gatekeeping and filtering information. In the process they have also managed to avoid subjecting their New Age conservative sound bites, through the public sphere, to serious debate and analysis in front of a mass audience.

We all learned to laugh at 'political correctness' over the last few years, and to stick up for its supposed opposite, 'free speech.' But political correctness is starting to look pretty good compared to the most recent alternative: not 'free' speech, but 'paid' speech. In the anti-public sphere, ideas circulate to the extent that they have corporate sponsors behind them and friendly, self-interested media gate-keepers to speed them on their way.

The anti-public sphere works in two ways. It bypasses the old public sphere and communicates directly with "target audiences," be they voters, political leaders, cultural elites or whatever. The diversity of media forms today makes this more cost effective than ever. Computerized direct-mail campaigns selling video tape packages, cable access-TV channels, computer bulletin boards – the Right has spent considerable money effectively experimenting with a wide range of cheap and flexible media vectors.

The anti-public sphere also casts its shadow over the old public sphere. A perfect example is an odious book by Richard J. Herrnstein and Charles Murray, *The Bell Curve: Intelligence and Class Structure in American Life* (Free Press). This book once again makes the case for the hackneyed claims that class differences are largely caused by genetic factors and are therefore immutable. It makes the usual leap from the defensible claim that an abstract, clinical measure of a thing called 'intelligence' is partly determined by factors of inheritance, to the rather stronger assertion that inherited intelligence, or lack of it, is the key factor at work in a whole range of social phenomena ranging from why black people do less well at school to incidences of violence.

The book, as Stephen Jay Gould noted in *The New Yorker*, "contains no new arguments and presents no compelling data to support its anachronistic social Darwinism." But why is a science writer of the caliber of Gould even bothering to review it? Because, for the first time since the civil rights movement, bluntly racist (non)arguments against the provision of welfare and education for the poor and the non-white have been taken seriously in 'quality' newspapers. Reviewers in *The New Republic* and *The New York Times*, while confessing their ignorance of psychology and statistics, have felt obliged to take this book seriously.

Now that political correctness is dead, every crank racist and homophobe with a press agent and a grant from a far-Right foundation has a crack at intellectual influence, if not credibility.

That certain ideas have been exposed as both self-serving and wrong no longer matters. That they appeal to the gut instincts of the still overwhelmingly white, male, 'well-bred' and well-heeled senior editorial staffers at American newspapers, is all that an idea needs to burble through the S-bend of American media gate-keeping, as it is precisely these kinds of prejudices and resentments that the anti-public sphere feeds on.

Herrnstein's research was supported by grants from a little-known foundation devoted to crack-pot eugenics, but it is published by the once respectable Free Press. Under Adam Bellow (novelist Saul Bellow's son) the Free Press has degenerated into the party political press of neo-conservatism – the ideological group-think that cements together the anti-public sphere.

Reaganism may be dead. The old man himself is conveniently losing all memory of the Roman snake-pit that was his White House, due to the unfortunate but timely onset of Alzheimer's disease. But the neo-con monkey-wrenching of the public sphere continues.

Post-Reagan, with the evil empire of the Soviet Union beaten and humbled, the anti-public sphere now rolls on domestic issues. Now it's time for attacks on the Great Society dream of a fair shake for all and on the 'counterculture' values that have been a persistent bugbear ever since '60s lit-crit star Lionel Trilling sniffed at anti-Vietnam demonstrations as 'modernism in the streets,' and the first wave neo-cons like Irving Kristol and Norman Podhoretz were there to proffer a hanky.

Kristol's son William, a former adviser to Dan Quayle, has inherited his father's mantle as a Washington pop-philosopher, and the Heritage Foundation has risen from the ashes of the Reaganite economic mess like a high price rent-by-the-hour phoenix. Heritage was one of the agents, along with the Olin Foundation, behind the attack on political correctness. No one knows how many millions were spent attempting to capture the front pages of *Newsweek*, *USA Today*, *Time* and even formerly respectable publications such as *The New Republic* with beat-up campaigns against any restrictions on 'free speech.' Of course 'free speech' now means paid advertisements by semi-credible 'scholars' in favor of racism, forced immiseration and wider powers for the police. The same foundations and the same hired gun, shoot-from-the-lip 'spokesmodels,' will also attack free expression in the arts if the moment calls for it and the price is right.

Heritage has also sponsored lectures by the new Republican speaker of the House, Newt Gingrich, large extracts from which appear in Rush Limbaugh's radio and cable-TV shows. Limbaugh, who has an audience of 20 million, makes a living telling off-color Clinton jokes and making frank appeals to the worst instincts of lower middle-class, white America. He praises Gingrich to the skies. Limbaugh is only the best-known of a network of neo-con radio hosts across the country who form an important part of the anti-public sphere's alternative to the mainstream press and TV networks, which the hard-core Right regard as far too liberal-lefty to be of 'use.'

Gingrich is a strange character to be taking over the mantle of a resurgent Congressional Right. A divorcee who can still rant on about 'family values,' Gingrich is also a former college professor and co-author of a book called *Window of Opportunity*

(Baen Enterprises, 1984) full of weird futuristic schemes. Peddled by a science fiction publisher, it contains Gingrich's 'conservative futurism.'

It's a none-too-accurate futurism, given that Gingrich was convinced "there will be Soviet labor camps well into our great-grandchildren's lives." Given what a godsend the Soviet Union was for neo-con gravy trainers who hitched their cabooses to the rapidly rising anti-public sphere of postwar America, it's no surprise they wanted it to go on forever. With its collapse, a few managed to scramble aboard the movement against new enemies – the counterculture left, women's rights, equal opportunity and what's left of the liberal intelligentsia. Gingrich was one of the more resourceful in terms of commandeering communications, if not the most ideologically convincing of the new post-Cold War neo-con warriors.

Gingrich makes no secret of the fact that he uses private money in his own contribution to an anti-public sphere free from the last vestiges of liberal intellectual filtering. His annual 20-hour video lecture series *Renewing American Civilization*, originally video-taped at Kennesaw State University, Georgia, used to include praise for corporations who had made contributions to GOPAC, his fund-raising political action committee. The Washington newspaper *Roll Call* reports that textile magnate Roger Milliken and bar owner Thomas Kershaw have appeared as "American success stories" in his lectures.

The Georgia Board of Regents barred Gingrich from teaching at the university when this came to light. Gingrich moved the taping of his lectures to the private Reinhardt College. In taking this action, the Board at Georgia upheld the traditional role of the public sphere, which is to maintain standards of quality and disinterestedness in the circulation of information. But Gingrich's lectures are taken as a university course for credit at 25 institutions across the United States, which is surely some index of the influence of the anti-public sphere.

One learns in Gingrich's course that there are "five principles of American civilization." These are personal strength, entrepreneurial free enterprise, the spirit of invention and democracy, quality as described by Deming, and the lessons of American history. (The mysterious sounding fourth point refers to the statistician Edward Deming, who became the guru of quality control in Japanese manufacturing and was belatedly adopted by industry in his native America.) Everything is in neat little lists like this, like a 12-step plan for giving up smoking. Only in this case it's a 12 step plan for using rehashed ideology, private money and modern communications for bypassing liberal common sense and grabbing power for policies the polls show people simply do not support. For example, Gingrich teaches that women are unsuited for combat roles in the military because after 30 days in a ditch they get infections," but "men are biologically driven to go out and hunt giraffes." This is the scholarly expertise subsidized by defense contractor Lockheed, a big employer in Georgia, with a \$US 10,000 contribution in 1993.

Not content with making the past video-friendly, Gingrich has adapted the pop prognostications of Alvin Toffler to his conservative futurist rhetoric. Toffler and his historian wife Heidi

have tried lamely to distance themselves from some of Gingrich's views, but seemed quite content to appear with him at a conservative futurist conference in Washington last January, where Gingrich discussed "From Virtuality to Reality." The conference was sponsored by yet another anti-public sphere thinktank, the Progress and Freedom Foundation, run by Jeff Eisenach, a longtime political associate of Gingrich.

"In a sense, virtuality at the mental level is something I think you'd find in most leadership over historical periods," says Gingrich. "But in addition, the thing I want to talk about today, and that I find fascinating, is that we are not at a new place. It is just becoming harder and harder and harder to avoid the place we are." While no one seemed at that point quite sure what Gingrich was talking about, the general drift was that America is passing through a transitional phase from an industrial to an information society. From a political point of view, Gingrich finds this analogous to the position England passed through between 1770 and 1800, in the transition from an agrarian to an industrial society. He attributes the success of English mercantile power in this period to the positive effects of the doctrines of Adam Smith had on taxation policy.

The Gingrich brand of futurism has all the flaws of the Toffler variety and then some. Historical evidence is cobbled together around a story-line decided in advance. What's scary is that this defective historical method, when it circulates in the anti-public sphere, is unchecked by debate with conflicting views. Having simplified the past beyond recognition and drawn a line into the future, all that remains is to liquidate the institutions and cultural forms in the present that appear as obstacles to this story.

To this historical simplification, Gingrich adds his little lists of the five this and the seven thats. Here we have the "five news" – new hope, dialogue, access, partnership – and a new team. It sounds less like the traditional methods of American public life than the pronouncements of the Chinese Communist Party.

**Window of Opportunity:**  
The flak that Alvin Toffler received from futurists over his pop prognostications is nothing compared to the conservative futurist rhetoric that Gingrich imagines. Toffler has tried to distance himself from Gingrich but appeared with him at a conservative futurist conference titled "From Virtuality to Reality."



## It is authoritarian knowledge for a post-critical age, dominated by the power and vested interests behind the anti-public sphere.

which also rants on about the "four modernizations" and so on, in handy little lists. This is a way of speaking not designed for discussion, but for rote learning; not for dialogue, but for taking down and regurgitating. It is authoritarian knowledge for a post-critical age, dominated by the power and vested interests behind the anti-public sphere.

The striking thing about the 'shift to the Right' in American politics is that it has nothing to do with politics. A skeptic would have to ask whether there is such a thing as politics in America anymore. As cultural studies professor Larry Grossberg argues in his aptly titled book *We Gotta Get Out of This Place* (Routledge), politics appears to have been replaced by a privately subsidized trade in cultural 'values' and emotions. Culture has swallowed politics whole and is now exclusively about affects, not effects.



For free speech to actually work,

it needs a few ground rules. Without them, one has the paid speech of Gingrich and Limbaugh and the racist speech of Herrnstein and Murray – and little else.

The Right grasped this early and has effectively used popular culture and modern communications to rewire the form and content of public life, tuning in to the twilight zone of the private lounge room of American feelings and motivating it to vote.

Since a mere 19 per cent of the electorate put Gingrich & co. in effective power on Capitol Hill, what America certainly doesn't have is a democratic public sphere. When supporters of the National Rifle Association make up a third of the voters, it is solely a question of which special interest can mobilize which grab bag of ideas and images and grab the hearts, if not the minds, of a subculture large enough to win power.

What presently works best is the appeal Limbaugh has down pat, to the fears and frustrations of lower middle class, white males. These are the group who made the Republican 'landslide' slide. What they have discovered is that affirmative action has started to work. White men don't have automatic first call on jobs any more. They have to actually compete on merit. They don't like it one bit.

A key focus is education, where affirmative action programs at many universities and colleges do in fact assign quotas by race, despite a series of continuing legal challenges to this questionable practice. Many liberals and genuine conservatives have for some time debated how best to recognize potential merit amongst applicants for university places. A middle-class kid in a plush private school who gets good grades may not really show as much determination and fortitude as a bare-pass ghetto kid who braves guns and crack and neighborhoods where most kids don't finish school at all. As Nat Hentoff argues in the *Village Voice*, the problem is that in America race is confused with class. Quotas for Black or Hispanic kids will go to middle-class Black and Hispanic kids, while really poor and deprived Appalachian white kids will miss out just as much as poor Blacks, Hispanics, Native Americans and Calathumpians. No wonder ghetto intellectuals – the rap musicians – hate the black middle class as much as the white.

The problem is that one cannot have a serious debate about these issues without political correctness. By political correctness I mean some ground rules about which self-serving crackpot ideologies have been ruled out of court by consensus, pending new evidence or arguments. By political correctness I mean a basic commitment to allot airtime with some fairness to all reasonable points of view and some tact and grace in disagreement. For free speech to actually work, it needs a few ground rules. Without them, one has the paid speech of Gingrich and Limbaugh and the racist speech of Herrnstein and Murray – and little else.

The anti-public sphere's most serious damage to American political life is that it has destroyed the grounds for compromise between interests by seriously damaging what rationality and filtering took place within the public sphere. The apparently reasonable speech of the public sphere was always a mask for competing interests, but at least it allowed a negotiation

between interests. Now that vague emotions of resentment and frank racism are fair game in the anti-public sphere, the protocols of negotiating between interest groups through a public sphere that was careful how it phrased antagonisms has gone out the window.

The anti-public sphere does not yet have it all its own way. One of the first things Gingrich did when he became Speaker of the House was to replace the Congressional historian with one more to his ideological bent. Christina Jeffrey was associate professor of political science at Kennesaw State University in Georgia before her shortlived Gingrich appointment. She was one of the few people there who defended Gingrich when the links between his university course and his political action committee GOPAC came to light. Her Congressional job ended following reports of statements she'd made, criticizing teaching materials prepared for the Education Department about the holocaust, that led to the denial of Federal funding to the project. Her criticism was that the views of groups like the Nazis and the Ku Klux Klan were not represented.

Ironically, Jeffrey came to evaluate the teaching materials for the Education Department through a typically anti-public sphere kind of logic. According to *The New York Times*, Jeffrey says "they assumed I would oppose that, because [prior to teaching at Kennesaw] I was at Troy State University in Alabama which had a conservative reputation. I didn't know anything about the holocaust." Of course all kinds of filtering mechanisms that operate in the public spheres of education, the media and public policy are manipulated by powerful interests through the careful selection of gatekeepers, filterers and evaluators. But in the public sphere you would still have to be an accredited expert in the field. In the anti-public sphere any convenient ideologue with an intellectual baseball bat to hand will do. The public sphere in America may now be stacked from within by hard-hitters trained and tempered by the anti-public sphere, but the corruption of public life is far from complete. Gingrich was forced to sack Jeffrey immediately.

In the light of Gingrich's blatant return of a favor in appointing Jeffrey, questions have been asked about Gingrich's relations with Rupert Murdoch. The two met last November, but both deny discussing either communications legislation or the lucrative \$US 4.5 million advance for two books Murdoch's publishing company, Harper Collins, offered Gingrich. No deal has been signed and Gingrich announced that he would not take such a large advance and would take royalties from sales instead.

What is disturbing in this incident is not what may or may not have happened – there is no evidence of a political deal between Gingrich and Murdoch. Rather, it is that the anti-public sphere creates the possibility of such a deal. Neo-conservative political operators, created by a network of private patronage from foundations and conservative media barons, may end up indebted to their sponsors for political favors of unprecedented scale and venality. ■

**The 19 per cent majority:**  
Republican's Bob Dole and  
Newt Gingrich meet President  
Clinton in the White House  
after the Republican 'landslide'  
in Congress.





ILLUSTRATION: TROY MUSSELMAN





# GRAND *Alliance*



There are those who claim digital HDTV will usher in  
a golden age of media technology

by Adam L Penenberg

Artwork by Ian Haig

HDTV IS INSPIRING BATTLES BETWEEN COUNTRIES AND COMPANIES. WILL THE GRAND ALLIANCE WIN THE LION'S SHARE OF THE HOME ENTERTAINMENT MARKET OR BE BEATEN BY THE GLADIATORS OF THE COMPUTER INDUSTRY? THE PICTURE MAY BE CLEAR BUT THE FUTURE ISN'T.

**I**t's no surprise the television and computer industries don't see eye-to-screen on HDTV. Attempts to combine TVs and computers into one product have never succeeded. In the 1980s, computers such as the Commodore, designed to display images on a television screen, were developed and quickly abandoned. Recently Apple tried to market a computer designed to hook up to television. This too failed. The two industries may never be able to put aside their differences, which would not only slow down HDTV development, but also delay the introduction of other promising technologies.

There are those who claim digital HDTV will usher in a Golden Age of media technology, not only changing the face of television, but also contributing to mind-boggling advances in science, medicine and entertainment. Lined up on the other side, however, is the computer industry, which contends that HDTV is doomed, that it will crash and burn, destined to be remembered not as a giant leap for technology, but merely a hiccup.

Whatever disagreements the computer and TV industries have over HDTV – and there are many – two things everyone can agree on. One is that "high-def" is still navigating through uncharted



**Early Warming System:** The first warm glow from a digital image will be RCA's satellite system delivering programs through a cable attached to a computerized box.

territory: There are no reference points to steer the process in the right direction, no way for companies to know whether their experiments will eventually amount to anything, no way of telling whether HDTV will, in the end, fly or flounder. The second: as with any big-budget Hollywood film, if the public doesn't accept it, HDTV will bomb. And badly.

Although television, on the surface, has become increasingly sophisticated over the years, basic broadcast technology has changed little since *I Love Lucy* ruled the airwaves. Indeed, the 4-by-3 boxy shape of TV screens dates back to old movies, which in the early years filled much of TV's burgeoning program needs. When movies changed shape in 1953, TVs remained wedged to their original screen-shape (the reason films must be reformatted for television). So why, after 50 years of analog broadcasting, is there this major push for digital HDTV now? Just four years ago, few in the United States thought HDTV feasible, but then the unexpected happened: The Japanese became the first to test an analog HDTV system — and it was like Sputnik revisited, with a contemporary twist.

1

#### JAPANESE-ELECTRONIKSTECHNOCASE HISTORY (TAKE ONE):

The '70s and '80s were a rough time for America: 'Nam, the oil shocks of the '70s, Watergate, hostages in Iran, the Reagan presidency, but nothing rankled Americans more than watching the Japanese wrestle control over market after market: automobiles, stereos, cameras, robotics, calculators. For many of the same reasons Americans didn't stand around idly while the Soviets developed technology that was out-of-this world, Americans couldn't allow the Japanese HDTV-challenge to go unmet.

2

#### JAPANESE-ELECTRONIKSTECHNOCASE HISTORY (TAKE TWO):

It took the '90s, a plummeting dollar (making Japanese exports more expensive), and a recession in Japan to level the playing field. But how did Japan gain control of almost every hi-tech consumer goods market in the '70s and '80s? They cheated. In order to gain market share abroad, and eventually push rivals out of business, whole industries would get together and collude on prices. In Japan, prices of electronics goods were two to three times those available abroad. By keeping prices high in their home market, and shutting out foreign competition ("We still can't sell our TVs in Japan," groused a spokesman for Thomson Electronics, makers of RCA), Japanese manufacturers could subsidize their exports. With the profits made at home, Japanese companies could afford to plow considerable amounts of money into research and development, helping them stay a step ahead of their rivals.

"We weren't paying attention to the Japanese and they were making incremental improvements," says Bill Hassinger of the Federal Communications Commission (FCC), which oversees the HDTV process in the U.S. "The Japanese demonstrated HDTV could be done, then the U.S. Government became interested."

Very interested. But times had changed since the days of President John F. Kennedy, whose response to the technological challenge the Soviets posed was to funnel billions into America's space program. In the case of HDTV, however, instead of being an outgrowth of the Cold War, it was, in many respects, the result of deteriorating trade relations with Japan. Instead of government sponsoring the research, it's government, this time strapped for cash, prodding companies to join forces and finance the project themselves, with the promise of a big payoff down the road.

Many Americans didn't want to lose another economic battle with the Japanese, didn't want to cede another potentially gargantuan hi-tech market, didn't want to see technology that was conceived and developed in America come back and haunt them — automobiles, robotics, stereos, TVs, faxes, all owed their existence to American research yet had been effectively re-packaged and sold by Japanese companies.

#### SO WHERE IS THIS ALL LEADING?

If all goes according to plan, and that's a big if, by 1996 TV watchers in the United States and, subsequently, around the world, will be able to plug into a new type of television, one that boasts the look, feel and sound of cinema. If TV is the vast cultural wasteland critics contend it is, at least the view will be better. High-definition sets will pick up broadcasts offering images crammed with two to three times the amount of picture detail currently available. That's up to 1,575 lines of definition, with a picture roughly the shape of a wide-screen movie image.

Think of your present TV screen as displaying a photo blown up to three times its original size and you'll see a blurry, grainy picture. That's what current television screens look like next to HDTV. Trees and grass, which often appear as a messy, green-crayon scribble on regular TVs are crisp and clear in HDTV. Likewise, moving images are sharper and colors are brighter and more clearly defined. Television manufacturers plan to include four-channel surround-sound to complete the home entertainment theater concept.

Already, billions of dollars have been shoveled into HDTV research and development, in Japan, Europe and the U.S. Last year, a group of American and European corporations reached an agreement to pool their money and research — "share the risks and rewards" — to form "The Grand Alliance," a sinister-sounding consortium working closely with the FCC to arrive at a workable "high-def" broadcast system.

The Grand Alliance consists of TV manufacturers Thomson Consumer Electronics (makers of RCA), Philips Consumer Electronics (Maganavox), and Zenith; in the computer corner is the David Sarnoff Research Center; then there's the National Broadcasting Corporation (NBC), Compression Labs, AT&T, General Instruments (a military contractor) and the Massachusetts Institute of Technology.

The alliance owes its existence to Richard Wiley, chairman of the FCC's HDTV advisory committee, who pressured HDTV suitors to unite rather than fight. The carrot: a chance to work alongside the U.S. government in concocting an HDTV broadcast system, an opportunity to influence HDTV's direction and gain a technological leg-up from the pack. The stick: another round of expensive, time-consuming tests, at a combined cost of \$US3.2 million, or a half-million dollars each, with no guarantee of surviving the next cut.

Grand Alliance members don't plan on taking advantage of their inside track by merely peddling TV sets, collecting license fees and waiting for inspiration to invent cool spin-off technologies. The FCC will soon require all of America's 1,500 TV stations to purchase HDTV broadcast equipment, at a cost of roughly \$US15 million each. NBC plans to present the 1996 Summer Olympics in HDTV. The rest of the world, they say, will surely follow.

Also by order of the FCC, all HDTV sets manufactured or sold in the U.S. in the next decade must be able to receive both digital HDTV and current analog transmissions, plus the networks will have to broadcast in both formats for the next 15 years. In order to do this all TV stations will be granted a second channel. At a date to be determined later – 2008 is what they're shooting for – analog transmissions will cease; stations will then broadcast one channel: digital HDTV.

The formation of this alliance is significant not just for what it may potentially do for members' profit statements, but also for what it doesn't do: namely, give sore losers a legal remedy in America's courts. Only lawyers are shedding tears over this. "I think it's unbelievable that companies who are vicious competitors are working toward an HDTV standard together," says Joe Donahue of Thomson Electronics. "It's almost like in World War II, when Russia and the U.S. fought together."

In some quarters, there's a heady optimism about HDTV flowing as freely and unfettered as pirated software in Southeast Asia. According to television-industry estimates, the potential market for high-definition television sets and related technology could easily top half-a-trillion dollars. It will lead to telesurgery, proponents say, enabling a doctor in Boston to operate on a patient in Mongolia. It will spawn home entertainment theaters tied into supercomputers, offering not only unlimited program choices and access to any television show ever aired, but also providing all the world's data libraries at the touch of a button.

The technology, they claim, will lead to more realistic simulation programs; tourists will be able to sightsee without leaving their living rooms; perhaps one day the lonely – or in the parlance of the politically correct, "the relationship challenged" – will be able to explore sexual relationships without risk, without commitment, without breaking a sweat; fighter pilots will be able to train without leaving their hangars; tank commanders will be able to experience casualty-free battle without venturing outside their barracks. And all because images caught on camera will become as clear, as "real," as, well, reality. In fact, the potential is so great, it's already beginning to worry some. Howard Rheingold, author of *Virtual Reality* and *Virtual Communities*, says the lines between news, entertainment and warfare have already blurred to the point where people are desensitized to reality.

"In the Gulf War," says Rheingold, "what you saw on television was virtually the same simulation as what pilots saw inside their planes and tank commanders saw inside their tanks. Contrast this with the view from the ground, where it was definitely not a simulation. Then they made video games out of this simulated combat." But those working to make HDTV a reality aren't concerned with such philosophical musings. They're after better TV reception (and an end to rabbit-ear antenna gymnastics), they want to be entertainment's future, they want HDTV to be our destiny. And while they're at it, they'd like to make some money.

"It took 10 years for color televisions to reach 10 per cent market saturation, seven years for VCRs, and five years for compact disc players," says John Taylor of Zenith. "We expect HDTV sets to achieve 10 per cent saturation in four years and project we'll sell one million sets the very first year. It has the potential to double our industry's revenues – from \$7 billion to \$15 billion in 10 years... Digital HDTV is to analog television what compact discs are to eight-track." Talk to the computer people and Taylor's analogy is likely to be flipped on its rabbit ears: HDTV, instead of being the electronics industry's next star and following in the footsteps of color TVs, videocassette recorders, "walkmen" and compact-disc players, could very well end up the eight-track tape player of the '90s.

## WHITHER HDTV

It's ironic that when the members of the Grand Alliance first met to discuss forming a consortium, they met in Washington, D.C., the nation's capital, a city known for compromise and corruption, filibusters and backroom wheeling-and-dealing. The nation's lawmakers are expert in the art of the deal: doing a little something for everybody without satisfying anybody. Since Grand Alliance members pursue separate agendas, there's a tendency to scatter a few crumbs among members rather than make the hard decisions; decisions necessary to advance the technology. This some say, threatens the purity of the technology and could lead to TVs that are too expensive, too complicated, sets that will produce inferior images, well below the quality necessary for consumer acceptance.

"We'll have to see how consumers react when faced with a choice between the new wide-screen TVs, which are getting better all the time, and high-definition TVs," says Paul Bachman, a video consultant to NBC. "It's not assured that HDTV will be successful. If consumers read articles that say the wide screen is as good as HDTV, they may not want to spend the extra money on HDTV."

It's impossible to know whether consumers will snap up HDTV sets when they hit the market. But if digital television, the first child of HDTV research, is any indication, consumers are certainly intrigued. In the U.S., Thomson is selling a digital satellite system dish antenna that delivers digital programming through a cable attached to a computerized RCA box. It can hook up to any television, and although it's not high-definition television, it does provide clearer images. But with a few glitches. For example, during a basketball game a three-point shot can look like a comet, with a glowing orange tail, streaking across your set. Spectators can be rendered as solid rectangles of color. And in

"HDTV will have a major impact on creative filmmaking. We now have technology that exists beyond the lens, a whole world of the imagination. And you can't film that with the old equipment," says Zbig Rybczynski, the director of one of HDTV's first films, *Kafka*, who honed his skills by producing short special-effects films for MTV and NBC. But what was cutting edge when the film was released two years ago is strictly a dinosaur today; the one-hour film, which swept technology awards in Japan, Europe and South America, is the HDTV equivalent to the first 'talkie.' "Nowadays there are films that combine reality and special effects, but this is extremely expensive," says Rybczynski from his Berlin home. "Soon we'll be able to accomplish the same with HDTV, but with a superior picture and at a fraction of the cost. Movies of the future, I'm convinced, will be produced on desktop computers."



**Metamorphosis:** From *Kafka*, HDTV's equivalent to the first 'talkie,' will evolve a cinema for the future produced on desktop computers, according to the film's director.

## (PREREQUISITE VOCABULARY)

**HDTV:** High-definition television, either the future of media or a technological hiccup.

**PIXELS:** Dots, either square or rectangular, that make up the lines that make up a television-screen picture. The computer industry prefers square dots – better for reading text; the TV industry has been using rectangular pixels for 40 years, which they say makes for a better picture.

**LAYER:** Each subsequent exposure superimposed on a high-definition video frame. It's like a double-exposure, then a triple exposure, then... well, you get the idea. In analog HDTV there can be up to 70 layers superimposed onto one frame; in digital, there's no limit to the number of layers.

**ANALOG HDTV:** Broadcasting waves of data. The major disadvantage with analog is the signal gets weaker the farther it has to travel. This can lead to snow, ghosts, or just a plain old bad picture.

**DIGITAL HDTV:** Broadcasting data in numbers; ones and zeros. Digital reception is either computer-perfect or non-existent, depending on whether the signal can get through unfettered. Digital is more versatile than analog, more accurate, and better suited for spin-off technologies. It's also HDTV's future.

**FCC (the Federal Communications Commission):** the American governmental body charged with the responsibility of working with the television industry on a standard for high-definition television. The FCC has mandated the gradual elimination of current analog broadcasting in favor of digital high-definition television.

**"PROGRESSIVE SCANNING":** Scanning is the way the television screen is illuminated in order to produce images. Better suited to the close-up work computer users generally perform, progressive scanning lends itself to razor-sharp graphics and eliminates flicker, which can cause eyestrain.

**"INTERLACED SCANNING":** This format is favored by the television industry. It's cheaper to use and lowers the price of television sets, cameras and studio equipment, and TV-industry folk would argue it also produces superior moving images, but it's poor for graphics and produces flickering. (Ever notice that whenever you see a television in a movie, the picture flickers and lines roll up to the top?)

**FROM THE TELEVISION INDUSTRY:** "Now, with the Grand Alliance, you have all the greatest HDTV minds pulling in the same direction. The pace of development is staggering. We plan on a field test this summer and based on those results hope to be able to announce the adoption of an HDTV standard." – John Taylor for Zenith.

**RE-BOOTING THE COMPUTER INDUSTRY:** "The process is upside down. The FCC has been running the process with an antenna when it should be thinking in terms of cable TV and laser disc, which is how HDTV will be delivered to homes. The whole info-superhighway – libraries at home, education, research – is not being addressed. It's hard to believe the higher cost of HDTV sets can be justified for merely entertainment." – Gary Demos, Apple Computers.

**WHERE DOES THE GOVERNMENT FALL ON THIS ISSUE?:** "[People representing the computer industry] are a bunch of technical weenies interested in their computers, multimedia and other narrow special uses. They act like they think this massive endeavor, involving the whole broadcast industry, should be bent to their whims." – Anonymous governmental source.

some cases, heavy rain during a movie can cause the picture to freeze up or disappear altogether.

Problems of digital paralysis notwithstanding, analysts are predicting sales of one million RCA boxes by the end of the year – at a cost of \$US700 to \$US900 per unit – which would represent one of the fastest introductions of a new consumer product. But manufacturers estimate the first HDTV sets to hit the market will cost \$US1,000-2,000 more than today's top-of-the-line wide-screens, significantly more than the RCA boxes.

Lancelot Braithwaite, technical editor of Video Magazine, says he too wonders how successful HDTV will be upon introduction. About 15 to 20 per cent of the public will spring the extra money on a good picture. About 60 per cent don't care if the football is green or purple just so it goes through their team's goalposts. The rest waffle. I assume it's going to be a slow start, like VCRs."

The first year videocassette recorders were available in the U.S. they retailed for approximately \$US2,000; 150,000 were sold across the entire nation. Now, 13 million VCRs are sold every year in the U.S. "Sure, money will be made eventually," Braithwaite adds, "but it will be the companies who hang in there for 10 years or more who will make it."

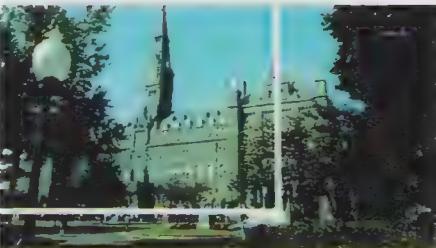
Assuming HDTV survives into the next century. The computer industry contends that by emphasizing entertainment over computing, fluff over substance, the Grand Alliance is making a critical error. Which could have been avoided if the computer industry hadn't been shut out of the HDTV sweepstakes.

By not making the computer industry more central to the process, the Grand Alliance has shot itself in the foot," says Gary Demos, digital advanced television consultant for Apple Computer. The whole issue of the information superhighway is not being addressed. It's tough to predict the future, but I think the Japanese experience is useful. They sold a few sets, and there are HDTV broadcasts everyday, but since all it offers is entertainment, it doesn't afford good value. It's been, on the whole, disappointing.

Computer companies claim their software, their screens, their technology are more appropriate for the future of high definition. For example, Intel and IBM say they will soon be able to manufacture software that will cure existing problems with digital television and also be easily upgradable. Thomson is sticking with its own television 'chip' technology. There's a palpable fear that if both industries head down separate technological paths, not only will HDTV be a mere blip on technology's radar, but that a golden opportunity to leapfrog into the future may have been squashed.

Of course, the issues dividing these two behemoths are more complicated – and at the same time less complicated – than hurt feelings about being closed out of the process. It boils down to profit power, the differing philosophies governing the commercial interests of each industry.

TVs are mass-market products designed to sell for as little as a few hundred dollars; low prices are crucial for success. Computers are more expensive and deliver a wider array of services. Consumers have proved they are willing to spend thousands of dollars extra for greater speed and power, portability, and the latest technical gadgets. HDTV manufacturers may have difficulty producing HDTV equipment able to bridge the gap.



**Special FX:** Aside from picture definition, HDTV is more cinematic in scale. The white line indicates conventional TV screen shape.

The biggest bone of contention is how best to display images on screen. Computer companies favor a "progressive scanning" technique, offering sharp graphics and eliminating "flicker" – a problem with regular televisions. Progressive scanning is better suited to the close-up work computer-users generally perform. Television manufacturers prefer "interlaced" scanning, cheaper to produce and, some say, superior in handling moving images. But there's a problem with flickering – unacceptable to computer-users. Instead of choosing one scanning format, the Alliance went with six; five that are progressive, one that's interlaced. TV stations will be allowed to choose the format. Although this sounds like a Solomon decision, since interlaced scanning is cheaper and broadcasters are already familiar with it, the computer industry has cried foul.

"The interlaced format is an enormous problem for us," Apple Computer's Demos says. "[The television industry] makes a number of claims. Interlaced scanning is more efficient for cameras, you get more value, more bang for your buck. None of these are correct. This may be true if you're talking exclusively about entertainment, but absolutely not for text."

Braithwaite agrees: "Broadcasters are not going to do anything that raises their cost. If they have the choice between doing it well or doing it cheap, they'll choose the interlaced scanning format, they'll choose cheap every time, unless people bitch."

And bitch the computer companies have. In doing so, they've managed to push the Alliance into incorporating square pixels into their proposed system instead of rectangular ones. Pixels are the microscopic dots of color, 212,000 per line, that produce the lines that form the picture. While it's easier to develop a display format based on rectangular pixels, most computer images are composed of square ones.

Says one government official involved in HDTV: "The computer industry wanted progressive scanning, they got it. They wanted square pixels instead of rectangular ones and they got that. They're a bunch of technical weenies interested in their computers, multimedia and other narrow special uses. They act like they think this massive endeavor, involving the whole broadcast industry, should be bent to their whims."

Herb Taylor, a research scientist at Sarnoff Research Laboratories believes these issues will eventually be resolved. "I think paths will merge, but with difficulties. A happy medium will have to emerge. Today, computers are like newspapers. The computer will come off the desk top and become more like a mural. And the TV will have to handle documents."

It's possible the two industries will smooth things over, reach a compromise both can live with. Or perhaps they'll continue to grapple like Godzilla versus the Smog Monster over nothing less than the future of media. Which is, in a way, the future of the virtual world. Our world.

## where's it all heading?

**HOME THEATERS:** "HDTV is on an evolutionary path to virtual reality. When TV is fully interactive you'll have a personal omnitheater. By early in the next century we'll have enough computing power so that you'll have a room dedicated to entertainment, a world in which you could fly around the world or have a virtual conference with your friends in some exotic, virtual place, and without goggles. In 10 years, your television will be served to you. TV will not be broadcast in a passive way. You will pick the time, the program, and it will be interactive. Choose the camera angle in the sport you're watching; customize instant replays. Check out golf courses by virtually-visiting them. Today, broadcast TV is a firehose entering your home and a straw leaving your home. But that's all going to change." – Herb Taylor of Sarnoff Research Laboratories.

**SOMA TO THE PEOPLE:** "If we're going to have 5-10 billion people in the world, how can they leave their homes? As life gets less pleasant consumer electronics will get more attractive. Is this a good thing? No. Is it what's going to happen? I think so." – Howard Rheingold, author of *Virtual Reality* and *Virtual Community*.

**SURPLUS OF WAITERS, OFFICE-TEMPS, BIKE MESSENGERS, AND PIZZA DELIVERY BOYS:** Already film sets can be produced wholly from computer software; soon, so will the actors. This means it will be possible to produce movies with far shorter list of final credits. Hollywood can't be happy about this.

**TWO FAVORITE HOBBIES:** "Virtual reality will be used for only two things: sex and golf. Look at Japan. People go to driving ranges and think that's real golf. I imagine it will replace rolling hills and greens in crowded, urban environments. Virtual sex will be like 'come' on your keyboard, a technological nightmare. VR will be another 'Rorshock test.' Fantasize what you want your sex to be like. Have a sexual encounter with Miss May or Madonna. We all have that daydream, but it pales next to the real thing. We at Playboy try to encourage people to go out and find real people, people who sweat. Sex will be used to sell a lot of machines. Eventually, we hope, you'll pass through that phase, and, hopefully, get a life." – James Petersen, senior staffwriter, *Playboy* magazine.

## the biggest losers so far...

**SONY:** In the '80s Sony said the numbers for an all-digital analog HDTV system didn't add up.

**MATSUSHITA:** ditto.

**NHK:** Japan's national broadcasting station. Pumped in billions into analog HDTV, resulting in sets retailing for up to \$135,000 and eight-hours of broadcast per day. Japanese companies, especially after America said, "arigatou but no arigatou" to analog HDTV as its standard, are waiting around for an American HDTV standard. So's just about everybody else.

## the biggest winners...

**GENERAL INSTRUMENTS:** an American defense contractor that proposed the first digital-HDTV system.

**BILL CLINTON:** The now-president can gleefully yodel, "Look out world, because America's back in the hi-tech arena, and this time we kicked Japanese butt."

**THE GRAND ALLIANCE:** Consists of TV manufacturers Thomson Consumer Electronics (makers of RCA), Philips Consumer Electronics (Maganavox), and Zenith; David Sarnoff Research Laboratories; National Broadcasting Corporation (NBC), Compression Labs, AT&T, General Instruments, and the Massachusetts Institute of Technology. They look forward to having a leg-up on the HDTV competition when it comes to developing new products, collecting mammoth licensing fees and selling a high-definition television set or two.

THE MAKING OF

# INTERACTIVE MAN

IN XANADU, DID TED NELSON, THE FUTURE OF INTERACTIVITY DECREE. ONE HUNDRED AND SIXTY YEARS AFTER COLERIDGE VISITED THE PLEASUREDOME OF XANADU WITH HIS POEM "KUBLA KHAN," TED NELSON TOOK A SIMILAR TRIP DURING ANOTHER ROMANTIC AGE. IN THE 1960S NELSON IMAGINED WORLDS WHERE IDEAS WOULD FLOW NON-SEQUENTIALLY AND INFORMATION WOULD BE FREE TO MOVE; AN ERA GOVERNED MORE BY FREE ASSOCIATION THAN FREE LOVE. HE CALLED IT HYPERTEXT AND IT SPAWNED NUMEROUS OFFSPRING. BUT THE FUTURE, HE SAYS, IS IN ANOTHER MODEL HE IMAGINED — XANADU, A PUBLISHING SYSTEM THAT MAY USHER IN THE NEXT MILLENNIUM.

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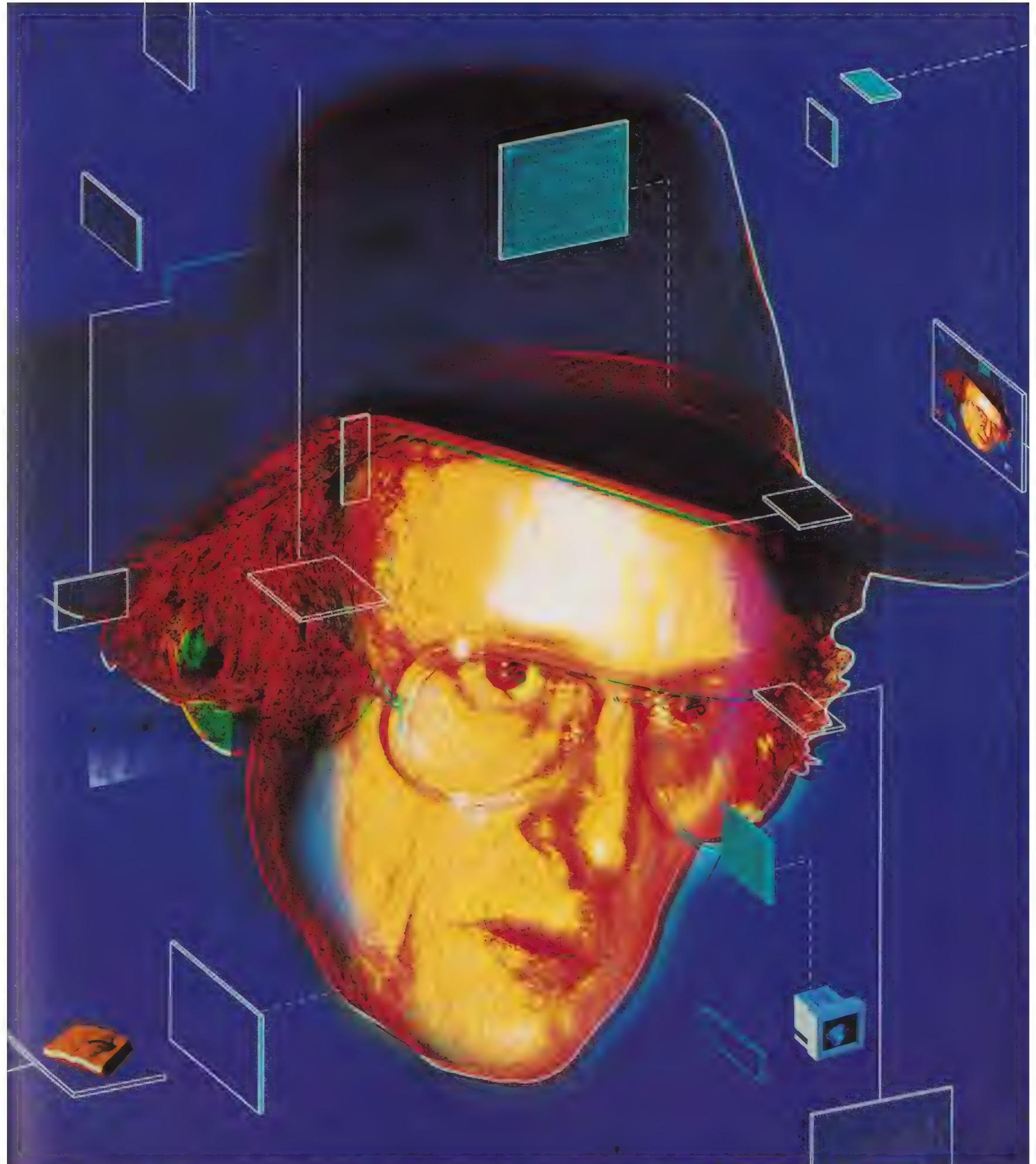
by Rosie Cross

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Illustration by Greg O'Connor

"I DON'T USUALLY TRY TO CLAIM CREDIT FOR IT, BUT I AM THE FATHER, IN A WAY, OF ALL THE INTERACTIVE software you see out there," says Ted Nelson, somewhat immodestly. "I am the father of network publishing which is taking off with the appearance of something called Worldwide Web."

"All the interactive media you are seeing," Nelson expansively claims, are the offspring of his fertile 1960s period. Embracing most interactive media as his own and shunning others as bastard sons — "especially CD-ROMs, which I detest because they are so limited" — has earned Nelson a mixed response from commentators whose descriptions of him fluctuate somewhere between maverick genius and madman.



## XANADU

Coleridge's opium inspired pleasure-dome described in his poem "Kubla Khan" provides the title for what Ted Nelson calls the future of interactivity.

## SAMUEL TAYLOR COLERIDGE

(1772-1834) Romantic poet; a critic, political journalist and philosopher. In 1798 he and William Wordsworth published *Lyrical Ballads*, a collection of poems that marked the beginning of the Romantic movement in English poetry. His greatest critical work, *Biographia Literaria* (1817), documents the theories of Romanticism.

The self-proclaimed father of interactive software is currently busy writing his autobiography and spreading the word about **Xanadu**, an electronic publishing service he first envisioned in the '60s.

Like many visionaries from that decade of optimism, Nelson remains a contradiction of idealist (in Xanadu "all authors and readers are considered equal") and cynic, claiming that his vision of technology has been almost fatally tarnished ("I'm very disgusted with the Macintosh and with software out there that is tied up in metaphors"). Now dismissive of many of the technologies he helped develop, Nelson is hell-bent on pushing Xanadu into the 21st century.

Establishing Xanadu hasn't always been a dreamy paradise. Nelson spent the '70s consolidating a team to design the system, as described in his book *Literary Machines* (1981). His Xanadu Operating Company was acquired by Autodesk Inc. in 1988 who invested around \$15 million on the project, and then dropped it, allowing Nelson to pick up the trademark.

Since then Nelson has sought to launch Xanadu on the world market, convinced that his latest brainchild would far surpass its predecessor, Hypertext. However, as any Netsurfer knows, Nelson's original concept has come to dominate the Internet and numerous software products, potentially creating the greatest barrier to Xanadu's realization.

While one paradox threatens to quash this latest entrepreneurial vision, another emerges. "I have all these people asking to meet me to talk about computers," bemoans the creator of interactivity. "'Hey Ted, how about a beer and let's chat about interfaces.' I want to hide from these people like the plague. But on the other hand, I try to get my ideas out there, and I spend a lot of time trying to put them in a form people will be able to read and find comprehensible."

These days, Nelson "tries not to be found" because he is "too busy." For a man not prone to socializing, 21•C found him more than willing to expound upon his theories and achievements.

### WHERE DID IT ALL START?

**Ted Nelson:** Well, it's not too easy. At the age of 11, I read **Buckminster Fuller** who said he was a journalist. So, I said 'Oh yes, that's what I want to be,' and ever since then that's what I have striven to be. In the process I am torn between my love of making movies, which is essentially my hobby, and my strong bent to abstract philosophy and academia. I read a lot of those on the fringes – **Marshall McLuhan** etc. So basically, I create new paradigms, in all the fields which I am really interested in. I have relentlessly worked, for example, in philosophy. In college I created my own school, which I am still endeavoring to get written in a readable form, called General Schematics. General Schematics is directly related to computer work. I have a new foundational theory of motivational psychology which I call the Theory of Bio-Status, and I have been working on that for about 15 years. But I am best known for my work in the computer field. An interviewer said to me recently "in the computer field, they may laugh at you to your face, but at night they dream about you," because a lot of the things regarded as being on the frontier and cutting edge right now are things that I founded and predicted in a way no-one did, and that they laughed at in the '60s.

I originally got all of my computer ideas the fall of 1960 and have been elaborating and working them out ever since. There were numerous setbacks because everything was so innovative and I don't like to do things in conventional ways. And I truly detest venture capitalists. Well, I have met some very nice venture capitalists, but I don't care to do business with them because keeping the ideas right is essentially an artistic job.

People say business is business, but it's not true. I want to achieve a certain effect in the world. Either you enjoy business to make money or you want to effect change. So the vision I had in the computer field is totally unified, singular, but because of the way the rest of the field has evolved, it has to be explained in many different words, and that's what it means to invent new paradigms. So, I had to study paradigms. Thomas Kuhn, the historian of science, popularized the term "paradigm," in the '60s, and he pointed out that scientific progress occurs by paradigm shifts – when one way of thinking breaks, and a new one is substituted in its place. Building on Kuhn's terminology, I define paradigms as ideas which do not map to one another. Paradigm confrontation is when two people have fundamentally different ideas, and one person cannot understand how the other could possibly say the things he is saying. This is a sign of paradigm confrontation. And paradigm warp is the way someone's idea gets twisted as misinterpreted through someone else's paradigm.

I have experienced it so much, in that people could not understand what I was saying, although I was saying exactly the same thing for roughly the last 34 years.

## BUCKMINSTER FULLER

(1895-1984) U.S. engineer, architect and inventor, twice expelled from Harvard he nonetheless evolved construction techniques which maximized efficiency and minimized costs by using interchangeable modular units. He is renowned for inventing the "geodesic dome" in 1947, based on the structural principles that he developed to achieve maximum spans with minimum materials. "How much does your building weigh?" the engineer was fond of asking.





JOHANN GUTENBERG

(circa 1400-1468) German goldsmith and printer, credited with the invention of printing from movable type. He based his techniques on wood-block printing and oversaw the first printing of the Bible.

My view in the 1960s – how it would have new forms of publication on networks and you would be able to draw forth any portion of any document or movie, and there would be an automatic royalty – would [elicit] a long pause, and people would look at me strangely. The problem was that there was no mapping this rather intricate presentation about reading from screens or network publishing or what copyright would become in an electronic era.

In those days we were told that computers dealt with numbers, and I was suspicious, because I was hearing too many other things that computers were supposed to be able to do. I took this course, and the scales fell from my eyes because, lo and behold, computers did not deal with numbers, except as a special case. Computers dealt with abstractions, and the art of working out things for computers involved a great deal of creating abstract structures. It said in the manual, that you could hook up to a computer screen and, *voilà*, miraculous things would happen. It didn't take me long to realize that this meant we would be reading and writing from screens, making movies from screens, and that the computer screen would eventually be the new hope for humankind.

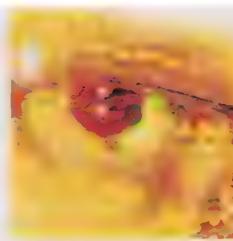
So my movie background and my abstract bent united to give me a stereoscopic understanding of computers, as no-one else had at the time. No-one saw them as truly abstract. A few academics did. And no-one saw them at all as show business machines, as I did. So I figured that it was destiny to work out the nature of publishing in the new world, and I figured I would be the new **Gutenberg**, and I would create a network for publishing. Publishing would be exactly the same, much more traditional than people realize. Publishing is exactly the same, people are creating works, they involve human creativity. They have inspiration or they don't, as the case may be, and they are published in an active publication which makes them widely available. So all of those things are the same.

Now the computer people talk about information and knowledge, but I try to avoid those terms because information has too many connotations. Knowledge, I was taught in philosophy, is true belief, so that immediately gets us arguing about what is true. I am not interested in arguing about what is true. The systems I design are for the storage and presentation of documents which are information packages which belong to people. And that was what we were creating, connections between documents. We would be creating non-sequential documents for which I coined the term "Hypertext."

I coined the word Hypertext – and Hypermedia, meaning "interactive media" – in about 1963, and published it in 1965. Hypertext I defined simply as non-sequential writing. There's no technical definition of hypertext beyond it, except that I require that the user be free to move. If it is a series of presentations where the user can't go back, for example, I think it is 'bad hypertext.' I suppose it is still hypertext, but it is bad hypertext.

I immediately set out to start a business – this was my second year in graduate school – which would have as its purpose the networking of all human documents. And I have been on the project without ceasing ever since. I gave it the name Xanadu in 1967, because the poem 'Kubla Khan' had been a favorite of mine. I became the spokesman of my friends who were programming, kept promising me it would be ready in six months, and lo and behold it wasn't finished, and so AutoDesk dropped all its sponsorship after five years, and I was out on the street. So 1993 was the long dark night of the soul when, unemployed and tormented, I tried to figure out what the hell to do next, and then I realized that Xanadu was a business model. It wasn't really technology at all. I had been wrapped up so long with the technological issues of this delivery system that I didn't realize that it was, pure and simple, a form of sale requiring contracts by both seller and buyer.

I am in the ironic position that Worldwide Web – and Mosaic which were created independently and have credited me with having inspired both of them with my book, *Literary Machines* – are taking off wildly now, and some people think that Xanadu has lost its window of opportunity. I don't think so. Xanadu has much more power than Worldwide Web and is also a complete economic and business model for the exchange of documents on-line with royalty when there are millions and millions of publishers in the game. Worldwide Web does some things very crudely, which I do more subtly. I've got more balls in the air than ever.



I define paradigms as ideas which do not map to one another. Paradigm confrontation is when two people have fundamentally different ideas, and one person cannot understand how the other could possibly say the things he is saying.

This is a sign of paradigm confrontation.

And paradigm shift in the way someone's idea gets twisted or misinterpreted

through someone else's paradigm.





### XEROX PARC

Xerox corporation's Palo Alto Research Center in California, whose most famous development is the Alto, a personal computer with mouse, overlapping windows, pop-up menus, and multiple fonts, which formed the basis of Apple's success. Fortunately for the heads of Xerox the idea had been snatched away by a company they had some financial investment in, but they still failed to see the potential for personal office equipment when, a few years later, Canon took hold of the personal copier market.

Xerox Corporation would have you believe that a document was text, and I think that's very silly. One of the things that is holding the computer field back is paper, and the notion that computers are going to just simulate paper, so they don't get their multi-dimensional characteristics.

I have an alternative design to all of the present available software. I am totally disgusted with the paradigm of software that was created at **Xerox PARC** in 1970. My designs in the early '60s involved being able to compare different versions of objects, shown in different windows. If you were showing the anatomy of a pig in one window, and the anatomy of a human in the other, you would have a line going from the sternum of one to the sternum of the other, from the snout of one to the nose of the other, pointing out resemblances and differences. Yet no window package on the market has this facility, because the great gods of Xerox PARC didn't think of it! I'm very disgusted with Macintosh and I'm very disgusted with software out there that is tied up in metaphors. I think metaphors are rather a bad idea, and I have designed a system which has no metaphors, no files, and no applications. It's called Zig Zag. It's no secret. It is based directly on my first paper of 1965, just as Xanadu is. So I think of myself as having gone on a straight line toward the truth, whereas most people have veered further and further toward error.

#### I HEAR YOU LOVE THE TITLE "MADMAN" AND YOU'RE VERY EVANGELICAL WHEN YOU PRESENT YOUR IDEAS.

The title "madman" usually means someone who is not operating on a current paradigm and they insist they are correct.

#### YOU MENTIONED YOU WEREN'T INTERESTED IN THE TRUTH, BUT THEN YOU SAID YOU WERE GOING IN A STRAIGHT LINE TOWARD THE TRUTH.

I didn't say I wasn't interested in the truth. I said that if we talk about computers holding knowledge, it gets us embroiled in arguments about what is true. I'm perfectly interested in having arguments about what is true, but not when it comes to designing data structures.

#### IS IT COMPETITIVE TO BE MAD IN AMERICA, ESPECIALLY IN THE FIELD OF COMPUTERS?

Well, nobody else seems to be occupying my corner, but I do find many people compete with me.

#### ANYONE FROM TERENCE MCKENNA TO CHARLES MANSON HAS BEEN LABELLED MAD.

Or Buckminster Fuller. If paranoia is defined as believing what others do not, then you could say I am clinically paranoid. We could take that further and say that there are two cures for paranoia. One is for the patient to cave in and cease to believe what the others do not, but I consider that to be the low road. I go around the world, endeavoring to persuade other people of my belief and succeeding from time to time, thereby curing my malady by having persuaded them.



**NOW YOU WANT TO MAKE AVAILABLE SYSTEMS OF TEXT WHICH ARE EASILY ACCESSIBLE AND RETRIEVABLE. BUT THERE IS SO MUCH INFORMATION AVAILABLE FOR FREE, WHY WILL PEOPLE WANT TO PAY FOR INFORMATION? IS XANADU SUPERIOR?**

There will always be free information and there will always be expensive information. People will choose what they want. There's certainly a rowdy cowboy ethic on the Internet now. They seem to think that all the information they could want is on the Internet now and will be free, and I don't think that's true. There will be copyright and I see it as my divine mission to make the copyrighters unobtrusive as far as possible, thus creating a world of shareable material finally divided as to ownership. **John Perry Barlow** is the most eloquent person in this field. I used to be, but he is now.

**JOHN PERRY BARLOW**

(barlow@eff.org) is a retired rattle rancher, a lyricist for the **Grateful Dead**, and co-founder and executive chair of the **Electronic Frontier Foundation**

**The popular interfaces and appearances of screens will change every year for the rest of history. Every artistic fad you can imagine will be that year's popular way of visualizing a document.**

**HOW WILL ELECTRONIC PUBLISHING EVER REPLACE THE BOOK? HOW CAN IT BE BETTER?**

It has to be better than the book in order to replace it. Let me stress, that to talk about interfaces is to misunderstand the problem. But the design of software is so atrocious that the things which should be easy are not, and it is still so much easier to handle paper than it is to handle files, and quicker. And until that is rectified, we will still be in a mess.

**SO WHAT WILL IT LOOK LIKE, WHAT WILL YOU CREATE TO CHANGE THESE THINGS?**

The popular interfaces and appearances of screens will change every year for the rest of history. Every artistic fad you can imagine will be that year's popular way of visualizing a document.

**HOW WILL YOU TAKE XANADU TO BED WITH YOU?**

I rarely go to bed. I am either too tired to read or I'm not in bed to sleep or to read. If being able to read in any location whatsoever interests you, then I suggest you buy a paperback. But for people who really want to explore and go through everything, voracious readers, I think systems like Hypertext will be indispensable.

**WHAT'S YOUR PREDICTION FOR THE DISAPPEARANCE OF THE PAPERBACK?**

Originally I thought it would be in 1962, so I have modified my predictions. But there will be a greater influence and importance placed on network publishing. There is already an important world of network publishing, but don't count on it staying the same. Each wave of immigrants is going to change the style of the operation.

I remember the first World Altair Convention in 1975 and there were perhaps 300 of us there. We were the cutting edge of the personal computer revolution and we thought that the people who bought personal computers would be like us. And now, of course, personal computer buyers are not at all like that first group, and it is going to be the same way with network publishing – the first wave of earlier adopters, then the next wave, and the next wave, and it will be an ever changing immigrant flux, will become melded into a largely similar culture, but with many pockets and subcultures.

**DO YOU FORESEE ANY OF THESE GROUPS OR YOURSELF BECOMING INVOLVED WITH A FAHRENHEIT 451 SCENARIO?**

I have always had that in mind. There are many people who believe in conspiracies. I was at a lecture recently where someone actually claimed that there had been a catastrophic event in history that none of us were aware of. Who knows what is true about these things? But one thing is clear, and that is there is always someone who wants information, but does not insist on reliability. Either it's a question of that or a question of being swamped by information. You can have attacks where groups decide to attack material they deem dangerous, or blot out some particular piece of writing or opinion. So, one of the problems is just to see if material can be passed on intact and the other problem is to authenticate it and bring it forth to a public in a later time, and both of those are big problems ■

**THE GRATEFUL DEAD**

Aged West Coast, pot-oriented hallucinogenic rock band renowned for their live performances which attract large crowds known as 'dead-heads.'

**ELECTRONIC FRONTIER FOUNDATION**

The U.S. lobby group formed to pressure the government to maintain independence within cyberspace.

**FAHRENHEIT 451**

Ray Bradbury's science fiction classic concerning a futuristic fascist state which has banned books, the title of which is allegedly the temperature at which paper burns. The book was written in 1953 as a response to McCarthyism.



WHEN DANTE ENTERED THE ABJECT WORLD OF HELL, IT WAS VIRGIL, A CLASSICAL POET, WHO ACCOMPANIED HIM AND EXPLAINED ITS MYSTERIES. IN A SIMILAR GESTURE, IT IS JAMES JOYCE, AS OPPOSED TO WILLIAM GIBSON OR R.U.SIRIUS, WHO COULD ASSUME THE ROLE OF GUIDE TO CYBERSPACE.

# the bairdboard bombardment

by Darren Tofts ■ Illustration by Greg O'Connor

Part of Virgil's appeal for Dante was ancestral, for he had previously taken a journey into the underworld in *The Aeneid*. As we continue to forge a brave new electronic frontier that goes by the name of cyberspace, Joyce seems a most appropriate guide. He too has been there before, and *Finnegans Wake* is a possible *Aeneid*, since it forecasts a rapidly changing world of communication with which we are still coming to terms.

Marshall McLuhan, among the first to recognize Joyce's importance in the age of media, described him as a clairvoyant. Radio, telephone, and cinema feature prominently in *Finnegans Wake* (1939), as does the emergent apparatus of television ("the bairdboard bombardment screen"). The television program also makes its first appearance in the *Wake*, well before it was cultural fact. But the *Wake* has also proven to be something of an index of telecommunicative change, anticipating the cultural impact of the succession of different media forms ("Television kills telephony... Our eyes demand their turn"), as well as the advent of hypermedia, such as virtual reality ("a dreariodrama setting, glowing and very vidual") and hypertext ("The proteiform graph itself is a polyhedron of scripture").

In their predictable search for ancestry, commentators from William Gibson to Michael Heim frequently describe *Finnegans Wake* as a forerunner of hypertext. Ted Nelson, too, has drawn attention to the literary characteristics of the medium; indeed, his most famous axiom, "everything is deeply intertwined", is distinctly Wakeian. Joyce exploited to the max the ability of the pun to compress two or more ideas or pieces of information into one word. His notorious "punsil shapning" crams individual words with such density that multiple meanings flicker in dizzying synchrony. But not merely content with extending verbal freeplay Joyce formed remarkable systems of links and associations within the book, creating the dense, web-like organization of information ("messes of mottage") that we associate with the term "network". While it occupies "paperspace," the *Wake* necessitates the use of an augmented form of artificial memory only conceivable in the computer age (which was not, in fact, that far away, for in 1939 Vannevar Bush postulated the idea of Memex, or memory extender, the theoretical system widely recognized as the foundation of hypertext). The best Joyce could hope for in 1939 was an "ideal reader suffering from an ideal insomnia."

*Finnegans Wake* has been described as a "hypermnesiac machine" that links information about different cultures, religions, philosophies and mythologies at incalculable speed. As a dream of human history, it is a collective unconscious ("the law of the jungler!"), where all language, all identity fuses into the public domain of universal memory. Nelson's dream of Xanadu still awaits fruition (it is, as the *Wake* was called before publication, a Work in Progress). Joyce has already created Babel. The parallels between Joyce's "nightmaze" and the Internet are irresistible. The common response of newcomers to both is of unmanageable excess; in their own ways they are both unreadable. The lack of co-ordinates entails unintelligibility in Joyce, disorientation on the Net (they are "too dimensional"). The ways in which we have come to imagine them suggest

liquidity, formlessness; Joyce's "riverrun" is cyclical, without beginning or end, and the Net is a bit-stream, a data-sphere. Language is no longer something we read, but float in. In both cases the need for guidance contributed to the rapid formation of communal identity. On-line help, bulletin boards, chat groups and the overall ambience of a shareware culture are the Net's equivalent to the reading groups and collective study seminars that enabled a generation of Joyceans to negotiate the matrix of *Finnegans Wake*.

Cyberspace, in Michael Benedikt's words, is "a territory swarming with data and lies, with mind stuff and memories of nature, with a million voices and two million eyes in a silent, invisible concert of enquiry, dealmaking, dream sharing, and simple beholding." Joyce's "babbelers" are no less garrulous than today's virtual community, and just as various. The *Wake*'s central character, H. C. Earwicker, is impossible to "idendifine," and the abundant permutations of his name (Here Comes Everybody, Haroun Childeeric Eggeberth, Heinz cans everywhere) parallel the diverse interest groups populating today's Huge Cyber Ecology, as well as the role-playing that takes place in IRCs and MOOs.

One of the most fascinating questions prompted by new media is asked in the *Wake*: "Where are we at all? and whenabouts in the name of space?" Where are we, exactly, in cyberspace? The cyberpunk vision of being jacked into the machine imagines an alternative sensory condition, a downloading of the mind into the matrix of pure information. While virtual reality environments offer convincing experiences of immersion in artificial worlds, other media such as Internet are inevitably rehearsing familiar terrain. The predominantly text-based character of Internet clearly means that if we are somewhere else, we are there notionally (to use William Gibson's term). The people we communicate with, perhaps fall in love with, swap ideas with, or simply chat with, are imagined in much the same way that we have traditionally come to know fictional characters, or the person whose letter we are reading. Cyberspace, itself, is something many Netcruisers would have initially "entered" in just this manner, through reading cyberpunk novels such as *Neuromancer*.

Joyce's hypermnesiac machine is a timely reminder that transformations of language are ultimately fulfillments of the desire to extend the possibilities of communication. The invention of writing was a technological revolution, the consequences of which are still being felt today. Writing promised the artificial extension of memory; hypertext offers "intelligence augmentation," the sensation of being everywhere in an information space. Writing introduced telecommunications; telepresence is one of the great attractions of Internet, and, indeed, the defining principle of cyberspace – the illusory sensation of being where you are not.

Despite claims that electronic writing is on course to transforming what we now call rationality, we will have to wait some time before we live in Xanadu. But of its potential impact on our already changing notions of culture, society, and identity, we can be in no doubt. We will be very different beings when we no longer think or communicate outside of electronic logic. ■

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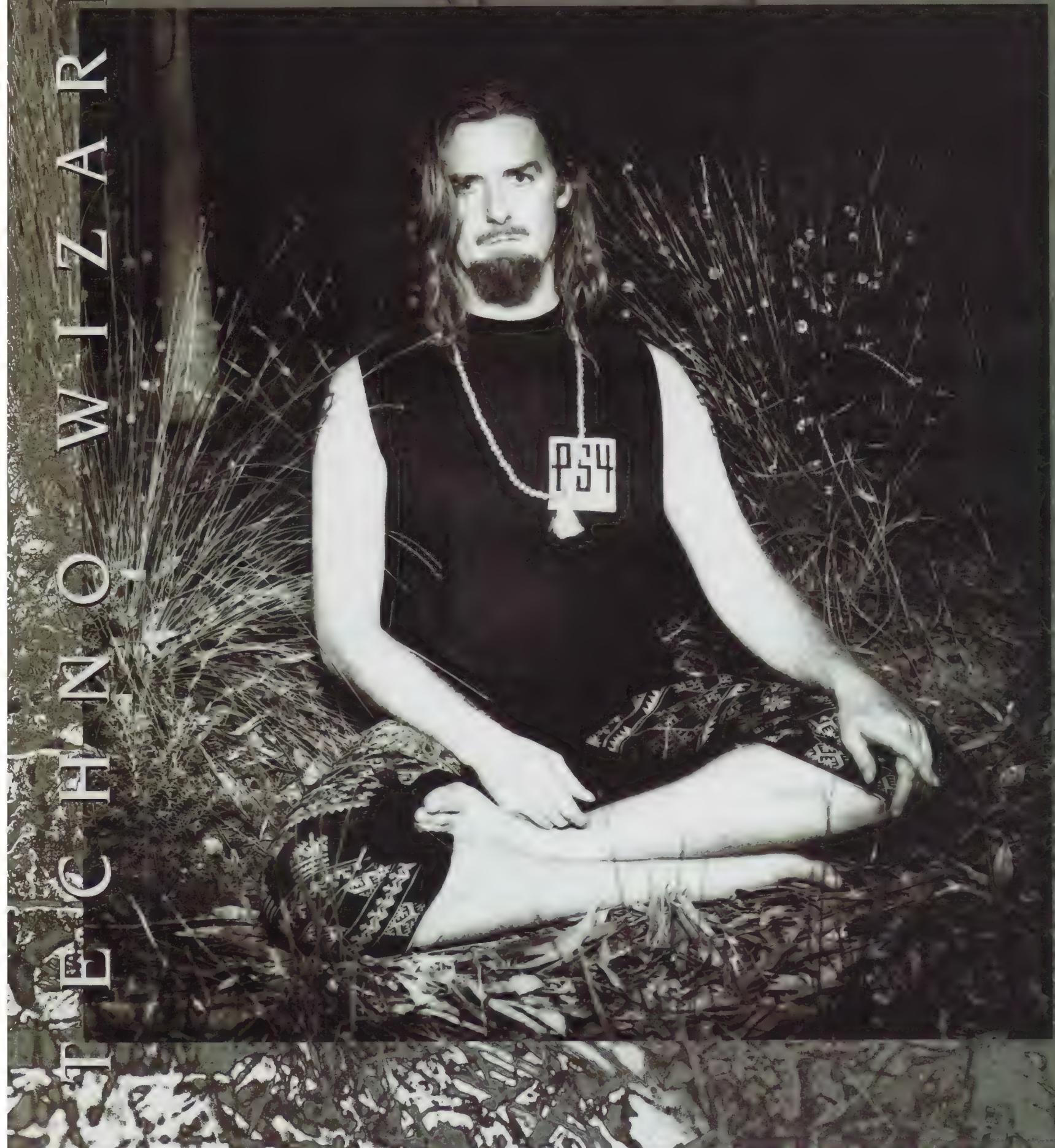
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OLD PUNKS NEVER DIE – THEY DISCOVER BUDDHISM, JACK INTO THE INTERNET AND MAKE AMBIENT TECHNO MUSIC IN THEIR LOUNGE ROOMS.

21•C INTERVIEWS OLLIE OLSEN AND SEES THE SYNTHETIC FUTURE OF POP MUSIC.

by Richard Guillatt

Photograph by James Widdowson

**B**ACK IN THE MID-1980S, WHEN OLLIE OLSEN WAS APPROACHING THE END OF what he now calls "my public phase in music," he would occasionally take to the stage of some grungy Melbourne rock club fronting a band called the Orchestra of Skin and Bone. Against a lurching cacophony created by a grinding violinist and an industrial percussionist slamming sheets of metal together, Olsen would hold center-stage, howling into a microphone and whipping himself into a state of heightened consciousness that occasionally ended when he lacerated his forearms with broken glass and exited stage left to the nearest hospital casualty ward.

This anecdote helps explain why some of Olsen's older friends still do a double-take when they run across him today and find themselves confronted by a long-haired, bearded, beatifically-smiling neo-hippie who quotes Buddha and lapses into rhapsodic spiels about the therapeutic spiritual effects of dancing. In appearance, Ollie Olsen circa 1995 would blend in nicely at a meeting of Friends of The Forest or perhaps a surf carnival. To those who've followed the changes in his ever-mutating personae over the years, this might well be the weirdest development of all.

But even though Zen equanimity has replaced punk anger, Olsen still throws himself with manic energy into whatever obsessions consume him, which at this moment are techno dance music and the youth culture which floats in its immediate orbit. As a founding partner in the Psy-Harmonics record label, Olsen has helped kickstart a nascent scene that barely existed in Australia two years ago. In a startling example of how technology has both accelerated and opened up the mass-media channels, Psy-Harmonics has since its inception barely two years ago, released 17 CDs, set up a Melbourne nightclub, and launched into ambitious plans for multimedia CD-ROM projects and interactive computer animation. They've also created Australia's first wholly synthetic pop group, the Shaolin Wooden Men.

Given that techno's warp-speed rhythms, absence of melody, and hammering repetitions have divided listeners even more dramatically than punk rock did 18 years ago, it's perhaps not so surprising that Olsen has been seduced by it. To the uninitiated – which includes a substantial proportion of the over-20 demographic – techno's beeps, burps and beats sound like Tangerine Dream on amphetamines, a description which is not intended as a compliment. To the converted, it's a mesmeric soundtrack to endless nights of celebratory communal dancing, a true digital underground culture.

"It's really funny," says Olsen, scarfing down dinner at a restaurant near his St Kilda flat, "because punk was there when I was a teenager and I was part of it. But in a way *this* is my time. It always frustrated me in those days. I mean I had Whirlywirl and for God's sake, we were an electronic band in Australia in 1978. Times were not easy. And when I walked into the very first acid house party here in 1988, I thought: 'Yes! *This* is what I've been waiting for. I've been predicting this for years, and now it's come.'"

For a guy who'd been up until 7 am at a rural techno rave in a state forest near Toolangi, two hours north of Melbourne, Olsen was looking surprisingly energized. Barefoot, dressed in a black Planet Teddy T-shirt and knee-length surfer pants, he enthused about the previous night's "earth bash," in which 800-odd techno fans drove to a signposted destination in the forest and stomped the earth until dawn under a full moon and a barrage of ultra-high decibel electronic beats.

The Toolangi event perfectly demonstrates the two defining characteristics of techno: one is its paradoxical mixture of digital technology and utopian earth-consciousness; the other is its complete self-containment from most mainstream pop culture. Whereas punk rock sought to attack the mainstream, techno seems entirely divorced from it, operating with its own networks of communication, its own audience, its own secret locations and meeting places. Ignored by radio and mainstream media, it simply carries on regardless and attracts an increasingly fervid following that is defined as 'underground' even though it appears to number in the tens of thousands, judging by attendance at major city raves worldwide.

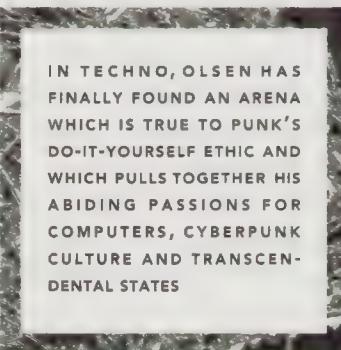
The Psy-Harmonics operation shares much of this do-it-yourself *modus operandi*. The 'groups' it has signed – a cosmic constellation with names like Zen Paradox, Mystic Force, Aquilla, LumuKanda and Third Eye – are by and large composed of just one or two guys armed with computers and a software program. The Psy-Harmonics studio is a bunch of recording equipment set up in the lounge room of Olsen's old house in South Yarra. This protean operation enables recording to be done very cheaply, which means that sales of only 1-2000

records are quite profitable within Australia. Meanwhile there's every likelihood that the label will reap far more money from Europe, where the techno scene is a massive phenomenon. Most of Psy-Harmonics' acts have already achieved distribution in Europe, and two of them toured the Continent last year under the auspices of Belgium's Nova Zembla label.

With its fondness for drug-induced good vibes, towering sound systems, transcendental dancing, smoke, lasers and a *faux-naif* dress code (peace signs, woollen beanies, cartoon character T-shirts), the techno scene comes on like a hot-wired, retooled version of 1960s counterculture. Psy-Harmonics CDs feature ethereal artwork depicting deserts and floating crystalline globes, matched with woozy song titles like 'Eternal Brainwave,' 'Starseen Transmission' and 'Everglade'; Olsen's group Third Eye recently released a CD called *Ancient Future* which features ambient synth instrumentals, a quote from Buddha about the transient nature of existence and a cover showing a rolling wave of surf cresting around an opened eye.

Hey, wasn't punk rock supposed to have exterminated this stuff?

"The hippie thing you mean?" responds Ollie affably. "Well, in the old days of 'never trust a hippie,' I didn't, and I still don't in a lot of ways. But there are a lot of good hippie elements... I mean, I really don't like the term Zippies that's being thrown around at the moment, but if you're going to call yourself a name, 'Zen Inspired Hippies' is not a bad one."



"When I was a punk I was always an electronic punk," he continues. "I was always into Eno and early '70s German music, that's what I was listening to before punk. I mean, hippies still annoy me: every time I go up to Byron Bay it drives me insane. 'Never trust a hippie?' Yeah, absolutely... (but) a lot of the kids who are weird mixtures of cyberpunk and hippie are very interesting people and really smart."

Angst and noise were pretty much the defining characteristics of Olsen's pre-techno career, which began in the late 1970s when – fresh from a Council of Adult Education course in electronic music – he formed Whirlywirl, a guitars/drums/electronics quartet who created a racket like a six-car pile up. The band disintegrated, after its ill-fated journey to conquer Europe left Olsen stranded and broke. He reappeared in Melbourne in the mid-1980s with Orchestra Of Skin and Bone, whose confrontational performances reflected their leader's growing frustration and anger. In retrospect, Olsen sees his self-lacerating stage-act as a reflection of both his own inner turmoil and an attempt to confront audiences with its voyeurism.

"It wasn't suicidal tendencies or anything," he says reassuringly. "Even though I wasn't aware of what shamanism was at the time, that's probably what it was. I used to just work myself into these incredible trances... I just used to put myself in this other state which was quite extraordinary. I felt no pain whatsoever."

The aggro quotient reached its height with No, in which Olsen screamed lyrics like "I'm a piece of shit!!" to a jarring electronics/heavy metal accompaniment which sometimes caused large sections of the audience to flee. Then in 1989 came the really strange sight of Ollie Olsen as an authentic, honest-to-God pop star, when he teamed up with Michael Hutchence of INXS to form the dance/rock group Max Q. The publishing royalties from Max Q's multi-platinum album provided Olsen with just enough money to buy himself a home recording studio and obtain enough LSD to push his brain close to complete synapses meltdown.

The unifying thread in all these projects – apart from their tendency to self-destruct on take-off – was Olsen's on-going fight to make electronic music with a minimum of money or popular support. In techno he says he's finally found an arena which is true to punk's do-it-yourself ethic and which pulls together his abiding passions for computers, cyberpunk culture and transcendental states. Luckily this has coincided with his decision to abandon drugs in favor of Buddhist meditation. In fact to hear it from Ollie there's a kind of logical synergy between the ritualized chanting of many non-Western religions and the communal gatherings at techno raves.

"The thing about techno is that it really crosses a lot of cultural boundaries because there is no language barrier," he says, rolling himself a cigarette. "It's like a soundtrack to people's lives – unlike, say rock music where you have usually got some anguished singer telling you how important it is that you should listen to what they've got to say. That's pure narrative, instead of having the beautiful abstraction of instrumental music, where it could take you anywhere.... When you trance into this music you really do lose for that period of time all that baggage that you carry around with you. And you actually might get to know yourself a little bit better."

**W**HETHER OR NOT YOU ACCEPT THE CONSCIOUSNESS-RAISING MANIFESTO THAT goes with techno, it certainly does open a window into the future of pop culture. That much is evident when you visit Psychic Harmony, the dance club run by Psy-Harmonics every Saturday night just north of Melbourne's central business district.

The club itself is your standard twin-floored dance emporium with luminescent landscape paintings, cheesy netting draped from the black ceiling, 44-gallon oil drums for tables and atmospheric fog machines. But the Psy-Harmonics team hit on the idea of setting up a table laden with computer terminals on a wide landing off the stairway. Hooked into modems, the terminals act as a magnet for a hardcores of technokids who congregate every night to cruise the Internet until the early hours of the morning.

It was here that I came across Chris Vangrass and Nik Trathen, a.k.a. Reefa and Toast, two young computer jocks who met at the club last year and struck up a

friendship – or rather, renewed a friendship, since they quickly discovered they had already been conversing for months in cyberspace via the Net. Both are techno fans who subscribe to the Net via a \$50-a-year service, giving them round-the-clock access to like-minded obsessives around the Net's global databanks.

When I arrived at the club they were sitting before their screens exchanging typewritten Net greetings and gossip with some techno fans in San Francisco. As a succession of techno songs thundered in the background and computer animations lit up the wall above our heads, Nik explained how the Net is "the closest thing to anarchy you can get," a limitless universe of information outside the jurisdiction of the usual guardians of culture. A compact 22-year-old with razorcut hair, board-shorts and T-shirt, he boasted that when Space Shuttle Magellan took some image-radar shots of meteors slamming into the surface of Venus last year, Nik had downloaded them from the NASA photo library before they even appeared on the evening news.

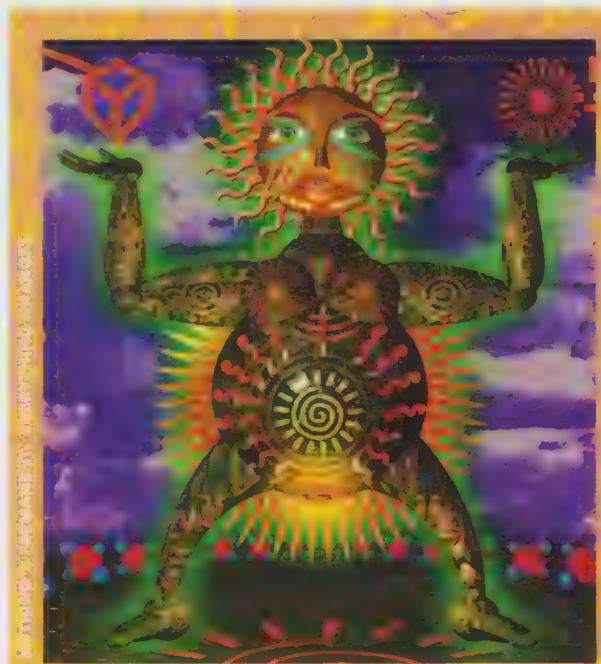
Meanwhile his mate Chris – a ponytailed 18 year-old who said he'd been using computers since he was five – was surfing through the databanks, giving me a guided tour of the Net's vast infomenu. We checked into the Elvis File and discovered that Gracelands was closed for renovations, bypassed the Lunar Institute of Technology and the Batal Institute of Indian Fine Arts, and finally settled for some spectacular pix of the Kluchevskos volcano erupting in Russia, shot from space. The surrounding conversation was getting hard to follow.

"If you Web to Deakin...?"

"Lykos?"

"No, what's that one with all the Gopher sites?"

I was beginning to see the corollary between techno music and computer culture. Both of them pump digital information at blinding speed, and both offer perfect anonymity to their creators. No one cares that futuristic-sounding techno groups are really fronts for old hippies like Steve Hillage and Edgar Froese, just as no one cares that your exotic Internet name-tag disguises a bespectacled dork with bad breath. Sitting in front of their screens, these guys didn't need MTV, radio or magazines to keep abreast of their obsessions, they simply downloaded whatever they needed from the Net.



"Wanna see the interactive Christmas tree?" asked Chris, whose fingers flurried over the keyboard even as he turned to talk to me. The screen filled with an image of a Christmas tree, its decorative lights winking in fuzzy video color. Another flurry of fingers and the Christmas lights changed color. It took me about 30 seconds to realize that we were watching a real Christmas tree in someone's lounge-room, its image being broadcast by video camera over the Net, its lights somehow hooked into the Net's system so that a global network of hackers could change their colors at will from a distance of 12,000 miles.

"Wow," I gawped. "So where is this tree, anyway?"

Chris turned to me with a look that was partly blank, partly baffled, and I realized that to him this question was almost meaningless. Everything in cyberspace is equally accessible no matter where it might be physically located in the 'real' world. As William Gibson says, the Net is potentially "the end of geography."

"I dunno where it is," shrugged Chris. "Somewhere in America. It's there," he said, indicating the glowing screen.

"It's in the Net."

**A**CROSS THE TELEVISION SCREEN WADDLES A squat animated figure with spherical head and arms. The figure assumes sumo wrestling poses as rapid electronic dance beats pump out a frantic soundtrack. Three other figures appear, robotic little men with globular wooden bodies and heads, pincer fingers and strange armor. Their heads expand like balloons, their arms jerk to the pummelling rhythm and a message scrolls across the screen: OUR MISSION IS TO RECONSTRUCT THE SONIC LANDSCAPE IN ORDER TO PRESERVE THE IMAGINATION

These are the Shaolin Wooden Men, the most audacious act in the Psy-Harmonics stable. Their debut CD came packaged with virtually no information beyond seven oblique song titles and a cover depicting the group's 'members' – SWM1, SWM2, SWM3 and SWM4. Their biography is a 31-line manifesto which describes them as "a gang of numbers" from "neo Hong Kong."

Like San Francisco's pop conceptualists The Residents, the Shaolin Wooden Men are an elaborate masquerade created by hidden human hands. But the difference here is that whereas the hooded figures in the Residents videos are clearly flesh-and-blood people posing for a camera, the SWM are an entirely synthetic construct, computer-generated characters who exist only in cyberspace. They're the pop performer that Max Headroom warned you about.

Troy Innocent, the 23-year-old Melbourne computer animation prodigy who designed the SWM figures, is circumspect about revealing too much about their identity. Just who composes their music is something neither he nor Ollie Olsen will divulge. Innocent first began working with Olsen five years ago when, as a teenage graphics student, he designed a couple of video clips for Third Eye. A techno fan and lover of Japanese animation (and its soundtrack music) he has since become the chief visual consultant to Psy-Harmonics, working on the office computer during his off-duty hours at the computer graphics agency Empire Ridge in Melbourne.

The SWM's just-released second album is called *We Are Sound*, a title the enterprising Innocent is turning into literal truth by creating a CD-ROM in which the characters on screen become a door through which you step inside the music.

Manipulate the little men and you manipulate the music itself by peeling back layers, pulling apart the building blocks of sound and reconstructing them to your own specifications.

"It's something that CD-ROM is perfect for, which is synthetic performers," enthuses Innocent. "The Shaolin Wooden Men's bodies will actually be composed of sound; they're the music and the medium in a way. They're fully synthetic techno creatures... when you interact with the little man on the screen, he will move and the movements will represent sounds. The whole track is stored within their bodies and you have to extract it by interacting with them."

In this interactive space, not only is the identity of the performer disguised, but the consumer will in a sense become the artist, composing music by 'playing' with the system. It's a concept that techno, with its electronic construction and repetitions, is perfectly suited for. Indeed, Ollie Olsen talks enthusiastically about a near-future when he might no longer need to make records in the conventional sense. Olsen recently participated in an experiment in which Third Eye performed 'live' over the Internet in a global performance broadcast which could well be a harbinger of things to come.

"I'm sort of looking forward to the day when the Internet is up and running enough, so I can live in the bush, not even need to come into the city, just pipe my music out to somewhere," he says. "It'd be great!"

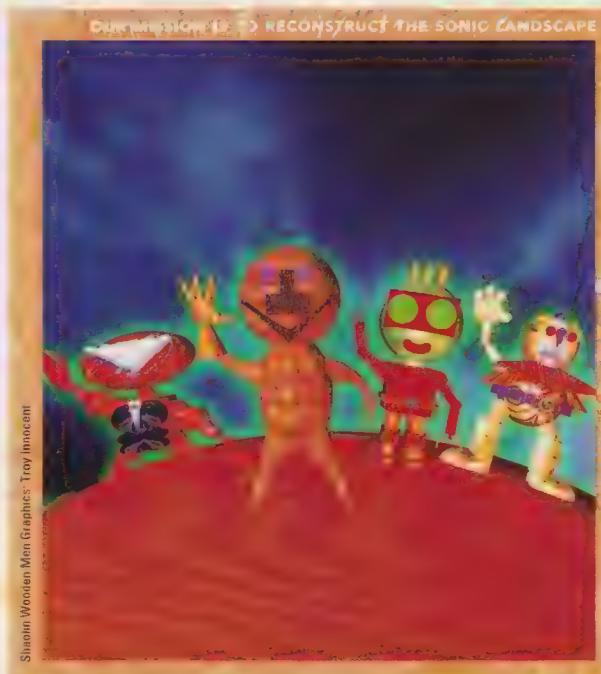
Well, maybe. If we're approaching the moment when virtual pop performers like Shaolin Wooden Men will download interactive music over the Internet, there is clearly a massive change underway in the whole conception of entertainment and popular culture. Already there are techno musicians like Frankfurt's Peter Namlook who record an album a week, pumping out their creations with a profligacy that is almost impossible to absorb.

This is the great dream of the computer age, of course – every individual empowered by hardware and software, everyone linked in the information web. But you don't have to be a bovine

antediluvian to be just a little unnerved by this vision of the future. The rigid mathematical construction of techno music, its very absence of human imperfections, gives a sense that the future might be a cold kind of place, no matter how many hug-drugs we take. The schism between techno and mainstream pop music shows how compartmentalized cultural cliques are becoming; Ollie's vision of the electronic composer toiling alone at home on his computers and downloading his wares to a coterie of true believers, suggests how much that process will advance in coming years.

Characteristically, Olsen is already agitating against the orderliness and rigidity of much techno, working on ways to disrupt the computer programs and throw improvisation into the mix. Inspired by the cut-and-paste electric jazz collages that Miles Davis pioneered on records like *Bitches Brew* in the early 1970s, he has been trying to convince a number of jazz players to participate in a project called Jazz Voodoo which would mix jazz spontaneity with hardcore electronic techno. How that would end up sounding even he can't predict.

"Nothing's permanent, everything changes," Olsen says with a Zen smile. "I don't know what I'll be doing in five years' time. It sure as hell won't be what I'm doing now."



Shaolin Wooden Men Graphics: Troy Innocent

# electronic

PERFORMANCE ARTIST STELARC IS TAKING HIS POST-HUMAN BELIEF SYSTEM TO THE WORLD, IN WORK WHICH SPECULATES ON THE FUTURE OF HUMANITY IN A TECHNOLOGICAL AGE.

by Nicholas Zurbrugg

Digital image by Greg O'Connor

HANGING BY HOOKS OVER TOKYO, ENDURING HIGH-VOLTAGE SHOCKS, swallowing an unfolding metallic sculpture or wielding roboticized limbs, are run-of-the-mill performances for Stelarc. Despite their sensational appearance, the philosophy behind these art-actions suggests an artist for the 21st century tackling the issues of life in a technocratic world. Far from the genteel activities of interactive on-line artists mixing pixels, Stelarc's approach is at once aggressive and physical as he faces the 'post-human' era.

However for a human being obsessed with interaction between man and machine his most endearing – and unnerving – feature is a perpetual guttural laugh as though Stelarc is constantly amused by our drab day-to-day life without a motorized third arm.

Amplified Body/Enhanced Image, Tsukuba, 1985  
Photograph: T. Shinoda, Digital Imaging: Greg O'Connor



WOOOO



biological bodies have organs.



images don't

the realm of the image may also be the realm of the post-human

#### HAVE YOU IDENTIFIED WAYS OF REDESIGNING THE BODY?

Most of my speculations are more conceptually interesting than physiologically practical at the moment. For example, when I was examining the body as an evolutionary development, I realized that the main differences between a chimp scurrying around on all fours and a hominid with bipedal gait were fairly slight changes in anatomical and skeletal structure. By slight modifications of musculature of the lower back and upper thighs, it was possible for hominids to have bipedal locomotion, and bipedal locomotion is probably the most significant event in our human history. Apparently the explosive growth of the cortex occurs after bipedalism. All of a sudden two limbs become manipulators, producing artifacts and instruments, and the whole relationship with the world changed. These minor anatomical changes produced a radical new orientation in the world.

So I thought, what about just looking at the surface of the body? If we were somehow to shed our present skins and develop a synthetic skin, it could perhaps breathe oxygen directly through its pores. We have already created membranes that are permeable to different gases, so perhaps if synthetic skin had photosynthetic capabilities, it could convert sunlight and moisture in the air into chemical nutrients. At this point, you could radically hollow-out the human body, because you wouldn't need lungs to breathe, you wouldn't need the gastro-intestinal tract to digest food, and you wouldn't need a circulatory system to convey oxygen and nutrients throughout the body. In other words, we could radically hollow-out the human body, simply by a change of skin, simply by shedding the skin, and we could then pack all these technological components into a hollow body.

I was intrigued by Gilles Deleuze's reference to "a body without organs." Quite obviously I'm coming from a different direction to Deleuze, but I've also noted recently that 'images have no organs.' In a virtual reality situation where a physical body can be transduced into a phantom entity, a virtual body, that virtual body becomes an operational agent. It's no longer a benign image that's simply hung on a wall or is transmittable through the communications systems; it becomes virulent. A virtual entity can become an operational agent that searches for information on the network for you, or that can remote-control a surrogate robot in a distant space. So images become operational agents. Biological bodies have organs. Images don't.

#### HOW DOES ALL THIS RELATE TO OUR SENSE OF WHAT IT IS TO REMAIN HUMAN?

The realm of the image may also be the realm of the post-human. If virtual images become semi-autonomous and are imbued with some sort of artificial intelligence, then we will have functioning operational entities within computer-software spaces that one can well argue have a life of their own, given that the medium is switched on and provides the sustenance for these images. In many ways, technology has become a better life support system for our images rather than our physical bodies. The communications media become the environment in which we generate and sustain and transmit images. And, of course, images displace instantaneously, whereas the biological body moves far more ponderously.

#### WHAT APPROACH TO YOUR WORK RECOGNIZES ITS ARTISTIC INTENT MOST ACCURATELY?

I think, most accurately, a performance artist. I've always been intrigued about how the body can become a medium of expression. Of course, you have to take the physical consequences for your ideas, whereas in painting you are dealing essentially with the illusion. In performance, it's the physical experience that's important.

#### WHAT ASPECTS OF PHYSICAL EXPERIENCE ARE YOU EXPLORING?

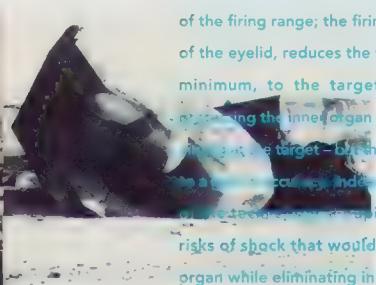
I'm particularly concerned about human/machine interface – the hybridizing of the body with its technologies. Not simply attaching technology to the body as an appendage, but also inserting machines into the body as a component.

There's a general strategy of extending performance parameters by plugging the body into cyber-systems, technological systems, networks, machines that in some way enable the body to function more precisely or more powerfully. Gravity is no longer the sort of molding factor that it was in our earlier evolution – the body now inhabits a technological terrain that is much more powerful, precise and intimidating. Technology speeds up the body so the body now attains planetary escape velocity and finds itself in new extra-terrestrial realms. So, for me, that raises questions about what it is to have a body and about how one might redesign the body.

The [monolithic] embrasure anticipates a relationship between the bunker and the limits of the firing range; the firing slit, like the squint of the eyelid, reduces the visual field to a strict minimum, to the target, with the aim of protecting the inner organ – in this case the man who guards the target – but this protection amounts to a kind of paradox, with the narrowing of the technical aperture, you eliminate the risks of shock that would destroy the human organ while eliminating in the same stroke the universal sideshow of the landscape. There is synesthesia here; protection accomplishes accuracy, and accuracy in turn protects. VIRILIO



Seaside Suspension Event  
for Wind and Waves,  
Jyogashima, Miura. Photo: H. Suzuki



WWII Bunker  
Photo: P Virilio

DO YOU LOOK TOWARDS THESE DEVELOPMENTS OPTIMISTICALLY? A LOT OF PEOPLE PROBABLY FEEL VERY THREATENED AND FRIGHTENED BY SUCH 'POST-HUMAN' DEVELOPMENTS.

I don't fully comprehend this technophobic streak and Frankensteinian fear. One has to remember that the very thing that's defined our humanity has been the production of artifacts, the manufacturing of instruments, the use of computers. What's determined our humanity has been our technology. Even religious thinkers like Thelhard de Chardin acknowledge that technology is an appendage to the body, by which human beings are released to achieve greater freedom. So technology is intimately connected with what it means to be human. I find more problems in our kind of carbon chemistry than in our silicon-chip circuitry at the moment.

HOW WOULD YOU REACT TO PAUL VIRILIO'S HYPOTHESIS THAT IMAGES ARE BECOMING ACCELERATED TO SUCH AN EXTENT THAT WE ARE NO LONGER CAPABLE OF ACTUALLY WATCHING THEM AND SO THINGS DISAPPEAR?

Instead of seeing new technologies as negative and frightening phenomena, I'm more concerned to ask how can we redesign the body to function in this intense information realm of faster and more precise machines. The language philosopher, John Searle, points out that in a high-intensity information environment, there's a collapse between intention and action. It becomes more and more a stimulus/response situation. We either learn to operate at those faster speeds or we construct systems that allow us to filter or delay some of our responsive actions. One has to remember, too, that functioning automatically is also functioning successfully.

We tend to have this romantic notion of the human body as a free agent, meditating, having time to make these learned decisions. But most of the functions of our body are conditioned, are automatic, and occur in split seconds. Our brain does what's called "forward-masking." If I touch something with the end of my fingertip, it takes a half-second for that signal to travel up, be processed, and for me to be aware of what I'm touching. But that's too slow in the real world. The brain, in a sense, through its conditioning experience, has an expectation of what I'm about to touch and forward-masks, actually anticipates. And that's what the definition of surprise is – when forward-masking doesn't synchronize with the actuality of that half-second response time that it takes for a signal to be processed.

The body has to function quicker. Whereas our metabolism and our circadian rhythms obviously are important for our survival and well-being in this biosphere, once off the Earth our metabolism perhaps will be a problem. On the one hand, we may want to be able to slow down metabolism so we can perhaps travel light years between stars. On the other hand, we may want to quicken our metabolism when we have to make critical decisions as a spacecraft is landing.

I don't think this is all sci-fi. We've had this cosmic catastrophe with this shoe-string comet crashing into Jupiter, only a few planets away. To remain on Earth is poor survival strategy. In reality, and in terms of our historical time, in terms of the survival of the species, we may very well need to inhabit the universe beyond this planet.

"I'M MORE CONCERNED TO ASK HOW CAN WE REDESIGN THE BODY TO FUNCTION IN THIS INTENSE INFORMATION REALM OF FASTER AND MORE PRECISE MACHINES."

"The more that a substance (space) becomes bombarded by high speed information particles (the overexposure of information)

the more space risks acquiring such a density that a chain reaction ensues. The result: disintegration, disappearance."

J.R.L.O



#### WOULD YOU LIKE TO DO THIS YOURSELF?

Well, yes. I did at one time apply to NASA as a mission specialist, but I got a curt response informing me that I was neither American nor qualified. But I made a point of applying as an artist and trying to justify the fact that artists should be up there as well as the military, the engineers and the medical personnel.

William Burroughs has similarly argued that man is an artifact designed for outer space and he suggests that now we've changed from the tadpole to human beings, the next evolutionary phase is perhaps going to be some biological transmutation which will enable us to live in outer space.

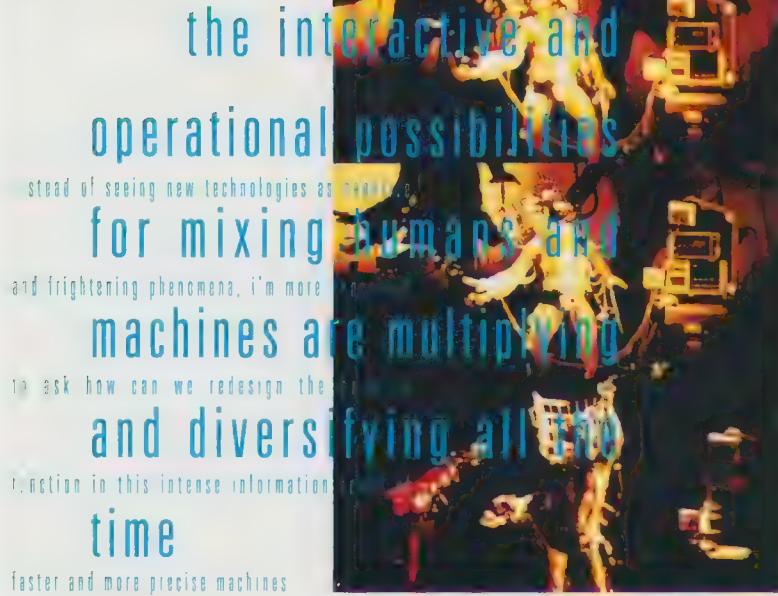
As we extend our operational space off this planet, we're simultaneously probing the internal tracts of the body and the software medium of computer technology and virtual images. I think we're functioning in multiple realms, in what we would call real space and time, in computer software spaces, while also invading the body with technology. Perhaps the most radical flip in our relationships with machines comes with this micro-miniaturization which now allows us to swallow machines. They'll be speck-sized – we won't even be able to sense them. Machines, bits of technology, will inhabit the internal tracts and soft tissue of the body, and the human body will become the landscape of machines. And this is a rather incredible situation.

Machines were once something external to the body, and the skin was once a container of the self and a barrier and an interface to the world. But once skin is erased, once skin is shed, once skin is penetrated and stretched and extended with technology, then it's no longer meaningful to see the self located in its biological body.



Micro-film image of the inside of Stelarc's stomach,  
Yaesu Research Center, Tokyo, 1993. Photo: M Kitagawa

Telesurgery: video and computer technology are combined in new surgical procedures.



Hollow Body Video Probe, ARS Electronica, Linz 1992.

Photo: Prammer/Sacki

#### DOES THIS MEAN THAT YOU ARE BASICALLY UNSYMPATHETIC TOWARDS METAPHYSICS?

I can't erase my cultural context or my genetic memory or my metaphysical history. Nonetheless, my focus is the body as a structure rather than as a psyche, or a site for inscription. The body as an object rather than as a subject. The body not as an object of desire but an object for designing. The body seen as an architectural structure where if you alter the architecture of the body, you adjust its awareness to the world. I think it's quite apparent that our five senses allow us only to function within a very small slice of the electro-magnetic spectrum and to operate only within very confined cosmic spaces. Our technologies have clearly extended our bodies and our operation in the world. So taking that a step further, if we alter our physiology, we alter our philosophy.

#### WHAT KIND OF PHYSIOLOGICAL OR PHILOSOPHICAL TRANSITIONS ARE YOUR PRESENT PERFORMANCES ADDRESSING?

One recent performance that really extended the limits of what I've been doing was the stomach sculpture. This was an electronic, self-illuminating, sound-emitting, extending-retracting structure designed as an artwork to be inserted in the body – the body no longer a perceiver of art, no longer a performer of art, but merely a host for an artwork. It was a very difficult project to do and emphasized my notion of erasing the skin as a barrier between public spaces and private physiological spaces.

I've also recently worked with a 6-channel muscle stimulator, with a computer interface, in order to choreograph, say, the whole left side of my body so that I can watch my left limbs move in space. I neither initiate that motion nor contract the muscles myself to produce that motion – it is done by a computer and by applying voltage to different muscle sites. At the same time, the right side of the body is controlling a mechanical third-hand and other extended technological devices. So voltages on the left side of the body cause involuntary movement, and the right side of the body voltages-out controlling technological appendages, further fragmenting and splitting the body as an autonomous agent.

I'm also working on a touch-screen interface where, with a modem, I'll be able to borrow a part of your body and perform an action or complete a choreography over long distances. This system for interacting remote bodies enables us to re-evaluate what a body is and what a body can do. One can see it either as electronic voodoo where you're prompting the body to move, or see it as a kind of true interactive situation where I can borrow a part of your body and make it perform a task in another space.

Virtual Arm Project Drawing Capability, CITRI, Melbourne, 1992.





The Third Hand, Japan 1981.

Photo: S. Hunter

Virtual Arm Scanning Robot, and Third Hand, TISEA, Sydney. Photo: Tony Figallo.

#### WHERE DO YOU THINK THIS KIND OF INTERACTION MIGHT LEAD?

With the remote control of surrogate robots, a body could control a robot or a colony of robots, or a group of human bodies might actuate a sophisticated machine. The interactive and operational possibilities for mixing humans and machines are multiplying and diversifying all the time, offering alternate strategies for the world. I'm not interested in immersing myself in the memory, in the genetics, of our past history, of our past biology. Let's present some alternate possibilities.

YOUR PERFORMANCES EXPLORING NEW TECHNOLOGICAL POSSIBILITIES SEEM PROVISIONAL RATHER THAN FINISHED THEOREMS.

They certainly are provisional. They certainly are speculative. The laser eyes simulate vision as an active transmitter and generator of images rather than as a passive receptor of light, and the third hand attached to and performing with the body simulates perhaps a future creature with multiple limbs. But there's no blueprint and there's no methodical research directed into any one particular area. These things are approached on an intuitive, aesthetic level. These performances aren't about Shamanistic displays of human prowess. They're not pseudo-medical scientific research. They're not yogic feats of fine-tuning to attain higher spiritual states. They're none of these things. They're simply works of art, exploring intuitively new realms of aesthetics and images.

Like John Cage, one might posit that "our souls are conveniently electronic," so that, in the best of circumstances, they are commensurate with the new technologies. But when you were saying we could have a number of humans programmed for a particular task, this might also evoke armies of slaves programmed to effect tasks in a certain way

Those sorts of notions are, of course, frightening. But one must realize that the body functions effectively when it functions automatically. You're already conditioned to perform in the world. You're not standing around making free decisions all the time. Most of your internal body functions are genetically programmed, and most behavior is socially conditioned, whether you're an engineer or an artist. A cynical definition of awareness is "that which occurs when you malfunction."

PRESUMABLY YOUR ART IS SOMETHING WHICH MALFUNCTIONS IN A POSITIVE WAY?

When I say that the body is largely conditioned, I'm suggesting that I would prefer the body to be conditioned to perform more as an artist than as a bureaucrat. If we can produce behavior that is constantly diversifying rather than converging, producing multiple possibilities rather than coercive solutions, then I think that sort of body would produce more interesting operations in the world.

SO YOU'RE MOST INTERESTED IN EXPLORING THE POSITIVE POTENTIAL OF THE INCREASINGLY MECHANIZED BODY?

Yes, although there is frequently an underlying anxiety that somehow our biological status quo is being threatened by technology. In science fiction, for example, machines are always destructive and metallic and shiny and uncaring, whereas human aggression, human fallibility, human jealousy, are romanticized as "what it means to be human." There is a fear that if we somehow erase these worst traits of our carbon chemistry, we will become dehumanized or mechanized; or that if we hollow-out the human body and create a structure that is not composed of water and air and carbon, that somehow this will result in machines that threaten the whole life-force of this planet.

But if we're really caring about life in general, and intelligence in particular, then any form of life, whether it be carbon chemistry or silicon-chip circuitry – any form of life that can perpetuate these values in a more durable or a more pervasive form – should be allowed to develop. So I have no fears on a personal level or on a species level. In fact, the problem now can be described not so much as a mind/body split, as a body/species split that will occur as bodies diversify in form and function and split from the human phylum.

ALL THE SAME, YOUR WORK SEEMS TO OFFER A FASCINATING INTERPLAY BETWEEN THE PHYSICAL AND THE TECHNOLOGICAL, THE VISCERAL AND THE MECHANICAL.

What's intriguing for me is to operate in these zones that are ambiguous, that are between biology and silicon-chip circuitry, between these realms of anxiety. If we were operating within spaces of certainty all the time, then everything would be quite predictable and not at all what an artist would pursue. So we are exploring those thresholds, those zones of slippage, those areas of interface, with anxiety, with hope and desire, but without romantic nostalgia or any Rousseau-esque notion of the biological body in a natural rainforest. ■



Robotics 90



IN A WORLD RADICALLY ALTERED BY  
COMMUNICATION TECHNOLOGIES AND  
CYBERNETICS, PAUL VIRILIO OBSERVES  
AN IMPENDING APOCALYPSE CREATED  
BY REAL TIME TECHNOLOGIES.

by Virginia Madsen

Artwork by Christopher Waller

Virilio claims that public space is becoming overexposed, over-lit. The "positive" horizon of political action disappears before the new "negative horizon" of an unconscious war waged by an information chain reaction on a par with the first atomic bomb. The "logic bomb" arrives.

Paul Virilio had been a surfer on the Internet long before it had swelled to become a tidal wave. When William Gibson wrote the cyberpunk classic, *Neuromancer* (1984), on his prehistoric typewriter, Virilio was also typing, at speed, having similar dystopian visions about the coupling of communications with computer techno-business. Like Gibson, he could see that the utopian visions inspired by the new technologies contained other dark matter. The specter of war.

In Orwell's apocalyptic year of 1984, Paul Virilio was busy working as an urbanist and essayist in France. He then had five books to his name. He now has 13 and is published in 15 countries. More books are on the way.

While not quite enjoying the cult status in the English-speaking world, of such colleagues as Jean Baudrillard or Jacques Derrida, his work has gained a wide and devoted following in and outside of France, particularly, he says, in those countries where hi-tech industry is the rising star of the post-industrial era – Japan, USA and Germany. He says he has so many invitations to conferences that if he accepted them all he would be in the air most of the time – not an ideal circumstance for a man who has spent years contemplating the nature of accidents!

Virilio follows in the long tradition of French intellectual engagement in public and political life. Along with teaching, writing and research he finds time to organize exhibitions and be a member of the French High Committee for the Housing of the Disadvantaged. He remains committed to the concept of public space: it is, he believes, only in public 'civilian' space that the possibility of political life and resistance resides.

But, increasingly, public space is now within computerized terminals. It is de-materializing before its image. Think of Tiananmen Square and the students holding up protest signs to the world's cameras, *in English*. Resistance happens here before the world's rapacious eyes, but according to Virilio, it risks being trapped by this same image which comes to replace the real event. The screen image is *in* the public eye and it can cause outrage, leading to positive chain reactions.

But, Virilio reminds us, the first casualty of war is truth. When Tiananmen Square became overexposed to the world, those same images were also available to the very forces against which they were initially directed. Video-camera footage 'accidentally' provided the means for surveillance of students, and the electronic space of Tiananmen Square could then be reconstructed for the eyes of another, more insidious, audience.

Virilio claims that public space is becoming overexposed, over-lit. The "positive" horizon of political action disappears before the new "negative horizon" of an unconscious war waged by an information chain reaction on a par with the first atomic bomb. The "logic bomb" arrives.

In Virilian physics, public space is now more than ever *temporal* space. Using Einstein's terminology, space-time is moving to the next phase in this cyber-world of relativity, and becoming what Virilio calls "Speed-Space." Digital information, and Real Time broadcasting constitute a "speed-space" which travels at the speed of light. It is in this new "speed-space" that decisions are made and vast wealth accumulated. As in war, the margin of advantage lies in the timing and speed of delivery.

But, Virilio asks, how fast is too fast? Is Real Time TV too fast, becoming a handicap? What about 'Real Time War' – Desert Storm courtesy of CNN – where reaction time shrinks to nothing? Can we still find a public space in the screen, a public voice and not just a negative image setting off unknown and 'accidental' chain reactions? Going too fast might result in losing precious reaction

time, akin to losing the time to think or reflect. If political democracy requires time, then these questions are not so abstract.

Virilio is, above all, a pragmatic man; an architect who knows his geometry and who knows that all architecture, physical or electronic, is tied up in *time*. For Virilio, one extreme is the monumental structure of the Arc de Triomphe which says to us, "I am an archway through which time stands still, and then marches." At another extreme, the TV studio, with its virtual windows (microphones, cameras, satellite dishes) brings time zones together and collapses them.

Arch and studio display different relationships to time and to speed. Through each port, armies can march and wars be waged. The in-between, 'non-place' of the computer interface, or the image in our loungerooms of the (continuing) electronic Gulf War, are at the heart of Virilio's concerns. He is an interrogator, a critic of "critical space."

His book, *Espace Critique*, (published in 1984 and appearing in English as *Last Dimension*) set out to challenge the naive belief that new technologies could be democratic and champion a new society composed of jacked-in, illuminated, interactive souls who could meet in the gravity-free space opened up by the infobahn.

Virilio entered the electronic megalopolis with the seasoned and alert eye of a 'war specialist' and urbanist, distrustful of the promises of Utopia, so familiar in the rhetoric of architecture. He claims that the origin of the city is *in* war, and that the architecture of war is not far from influencing the cyber-cities of the future – extensive surveillance being one sign of this tendency. In his latest work he suggests that the computer interface could just as easily lead to a 'Global Ghetto' as to the Global Village.

When Virilio invokes 'critical space' he means it in a number of ways. First he references the concept of "critical mass," a concept literally at the core of the atomic bomb. In relation to Real Time



media, it could be explained like this: The more that a substance (space) becomes bombarded by high-speed information particles (the 'overexposure of information') the more that space risks acquiring such a density that a chain reaction ensues. The result: disintegration, disappearance.

"Today what is threatened is not only the planet, the water, the air, the earth, the flora, the fauna, which concerns ecology," he says, "but space itself. Space is threatened with dissolution, disintegration."

"It is a tendency, and tendencies are what interests me."

We are speaking in the library of Paris' prestigious Ecole Speciale d'Architecture where Virilio is director. "When I wrote this book *Espace Critique*, William Gibson published *Neuromancer*, which announced the coming of virtual space," he says. "He prefigured the possibility of actually living in a virtual space and of acting in this space. From my perspective as an urbanist and essayist, I could see that this event announced a crisis in the idea of space, in the very notion of space itself. Not simply as expanse, breadth, depth etc, but as a *critical space* where humans practise and conduct their lives."

"For me, critical space is the result of the development of all the technologies over the last two centuries; first, of the transport revolution which has reduced the time-distance of transport – trains, cars, planes, guns. And, of course, all the technologies of transmission. I mean particularly, technologies which permit '*Le Live*,' which permit instantaneous intercommunication at the speed of light."

"For me space is essentially what we practise, what we use. There is a space-time of astrophysical abstraction, yes, but it is not of the domain of practice, it is not of the domain of the physical life and practice of man. Even if some men went to the moon with their Apollo rockets, they didn't really enter this space. They were sent to another world, an 'off-world,' they arrived, and fell on the moon, but I don't think you can say that there was any proof from this *fall*, that this anti-space was really a space."

Virilio can sound like he is playing games with language, but this is crucial territory too because science is not only expressed in numbers, but in language. It's therefore open to interpretation, rhetorical display, strategy. War games. There is a sense of urgency that he doesn't want downplayed. He frequently interrupts the flow of conversation, slapping his hands together, indicating physically, noisily, how space is in fact collapsing, with a bang. A big bang.

"Space is threatened, just as the oceans are threatened by pollution or the forests are threatened by acid rain."

He denies being a millenarian, obsessed by apocalyptic endings, finalities; yet another French philosopher uttering those words, 'the end of history, the end of politics, the end of....'

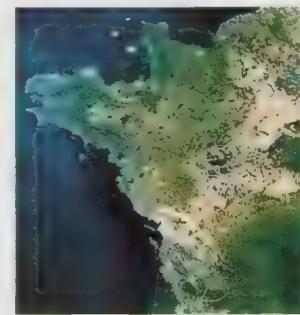
"Quite simply, it's progress," he says. "It's like the atomic bomb in relation to all the other bombs before it. 1914 to 1945. It's nothing really. In historical terms it's nothing, two generations.

Twenty years. From a bomb that made a *boom* to a bomb that killed two hundred thousand people in a moment. That's apocalyptic, yes, but Virilio is not apocalyptic! The world is apocalyptic. Technology is apocalyptic. Relativity itself."

War is never far from Virilio's thinking. It is the subject of his early books but, in his latest work, *L'Art du Moteur* (The Art of the Motor), he reflects on media freedom, virtual reality, artificial intelligence, nanotechnology, bungee jumping, the expansion of golfcourses, the war of communications.

Virilio is always on a reconnaissance trip, going back over old territory, retracing it with new insights. Unlike many of us, suffering from data overload, screen fatigue and the delirium of information, Virilio doesn't yet show signs of info-jet lag.

In a 1982 interview he said, "As a child I suffered the war, the destruction of the city of Nantes. I was terrorized by the war, war was my father and mother. I didn't do it on purpose; one doesn't choose one's parents. Later I fought in the Algerian war, as a draftee. I'm not bragging about it, quite the contrary, it's tragic. But both these wars initiated me into a profound understanding of the military phenomenon. War was my university."



30 years of research and reconnaissance around these strangely compelling relics: "My objective was solely archaeological. I would hunt these gray forms until they would transmit to me a part of their mystery."

Virilio is no different today, gazing, as he is, into the hidden crevices of the cyber-coastline. He is still hunting mysteries, but now it is the mystery contained within technology. While everybody is having a good time talking 'progress' at the techno-party, Virilio cautions that technological 'objects' are not neutral tools but a part of the larger cultural space that he calls, "Greater Nature."

"Space, such as we know it, as the history of humanity knows it, is a space on the way to disappearance. Our life is conducted not only in nature, that is to say, in the air, water, earth, landscape, but it is also conducted in 'Greater Nature.' Man has need of a scale of space, of proportion. An architect knows that if you lower the ceiling too much, if you make the room too small, it becomes uninhabitable. Prison is the queen of uninhabitable spaces."

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SIPA

Now, transport technologies, especially transmission technologies, reduce the space of the world to nothing. You get a kind of pollution of space, pollution, not of nature, but of this 'Greater Nature,' which is humanity's milieu, and which is 'life-sized.'

"We are born of the Earth, and our world is rapidly becoming uninhabitable. Not because it will be destroyed by the atomic bomb, or pollution, as the ecologists say, but by the pollution of distances. I felt this claustrophobia when I went to Japan. Going from Paris to Japan in 14 hours, I had had the sensation that the Earth was huge. Since I went there I felt it shrink, definitively. It's an irreversible experience. When I was 'live' in communication with Tokyo... it was finished! Already for me the Earth had become a virtual

distance. I believe that virtual space, before being cyberspace, is that.

"This rapidity of telecommunication is leading to a world divided into two categories, into two speeds: the speed of the real and the absolute speed of electromagnetic waves. This is the real drama of the society of the next century: two societies, one which is going to live in the real world because these people won't have the means to accede to the virtual world, and the other in which people will live in the virtual world and will be disconnected from reality. There will be the valid and the invalids."

Virilio questions this notion of progress.

"Let's take atomic energy, atomic energy represents a techno-scientific 'progress,' not only in terms of the bomb but it is also nuclear energy which allows a house to be lit. At the same time it is also a drama. Every time a new technology is invented, a new energy harnessed, a new product made, one also invents a new negativity, a new accident. To invent the train, you invent derailment; to invent the plane, the crash; electricity, electrocution. Inventing telecommunications is to invent the world in a microsecond!

"I'm not saying that we should return to old technologies, rather I am saying that we should, after two centuries of positivism and idealism of techno-science, come to critique the negative aspect. Not so as to deny the positive but so as to see it, 'life-sized,' in the totality of the landscape it inhabits."

In Virilio's work he has stated that, for the most part, the 'Greens' don't see the proper terrain of ecology: "They [environmentalists] see the gravity of the destruction of the flora, the fauna, the whales, the elephants... and they are right. But, being materialists, they don't see the degradation of space-time, because space-time, it's what? Nothing. It's gray. No colors!"

"My concern with the pollution of distances, and of this Greater Nature, is what I call a 'Gray Ecology.' It's not green; it's not only concerned with substances, grass, fauna, little birds... but with the 'Grandeur Nature.'"

Virilio's gray ecology goes all the way back to the days when he was studying the Atlantic Wall. These gray, almost impermeable structures looked like ancient tombs or pyramids, hiding a treasure, an army digging in with its ideology, a vast arsenal against mortality. Death is contained in the logic of these now-empty tombs. Thirty years on, Virilio believes, death is hidden in all of our technology. Is this an apocalyptic message or simply banal?

"It's banal, I know, but I believe everything we produce is marked by a potentiality or energy for Good and Evil, and that is the same for all that we produce. There is something inside of it and we should be seeking it out. It's hidden in the object – take



electricity for example. Of course it's good, that's obvious, everybody already knows about that, but there is a flaw. What is it? Electrocution of course, but that's only the first degree of the negative. What else?

"It modifies the vision of the world, and we could add, *it kills night*.

"There are no pure technologies. Everything has a hidden face, and the more it is hidden, the more it is threatened by its own accidents, by its negativity. This is the basis for a new intelligence of technology. And it isn't only technology, it's the effects of technology on the world..."

"It's obvious that what is proper to human history is acceleration without stopping. We have reached different stages of speed, without ever looking back. We have developed relative speeds in order to reach absolute speed. The history of humanity is also a history of the acceleration of humanity: that is, the reduction of the time-distance between one point and another. First the horse, then the car, the train etc. And finally television, tele-action, *le live*. We can't understand time, the time of man, time-history, without the development of acceleration. Now, behind this acceleration is a law. In physics it's called, 'the law of least reaction, the law of least effort.' Man is subject to this. We are subject to weight, to gravity, to terrestrial attraction, and then to fatigue. Technoscience develops economies of effort. Riding a horse economizes the effort of the legs, to go by plane is tiring but not so much as walking! With television, there's no longer any effort at all.

"Absolute speed is the absolute economy of effort. One stays put but it's possible to be everywhere, like God. The image of God is one of ubiquity, instantaneity, omniscience. It's the one who is there, who is everywhere. That is at once the end of all our efforts and at the same time the end of man as 'freedom of movement.' This is *inertia*."



"The threat is inertia. It is pollution. It is the pollution of the integrity of man. 'Man is the measure of all things,' said Pythagoras. The measure. The size, grandeur, dimension. Technology lessens this integrity under the pretext of economizing man's efforts – intellectual, muscular, critical.... Economizing is OK so long as it doesn't end in silence.

"We are being induced to economize the effort of talk, of critique." Bang. Down comes Virilio's hand onto the desk.

Then he lifts a finger to his lips, and leaning forwards whispers: "Shh! Shh!" ■

The Arc de Triomphe says to us,  
"I am an archway through which time stands still,  
and then marches."



Courtesy French Embassy, Canberra

Like Gibson, he could see that the utopian visions inspired by the new technologies contained other dark matter. The specter of war.

"From a bomb that made a boom  
to a bomb that killed  
two hundred thousand people  
in a moment."

That's apocalyptic, yes,  
but Virilio is not apocalyptic!

Technology is apocalyptic.

The world is apocalyptic.

Relativity itself."

death is hidden in all of our technology



The more that a substance (space) becomes bombarded by high speed information particles (the 'over-exposure of information') the more that space risks acquiring such a density that a chain reaction

Today what is threatened is not only the planet, the water, the air, the earth, the flora, the fauna, which concerns ecology, but

space itself. Space is threatened with dissolution, disintegration.

Every time that a new technology is invented, a new energy harnessed, a new

It was no longer in distance but rather in burial

that the man of war found the party to the

product made, one also invents a new

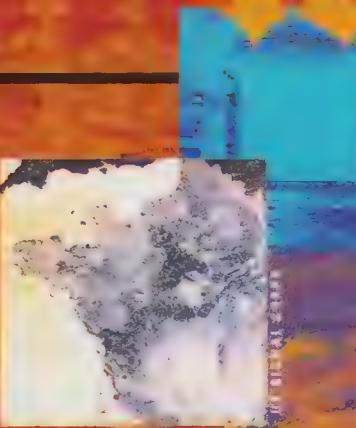
onslaught of his adversary; retreat was now into

negativity, a new accident..

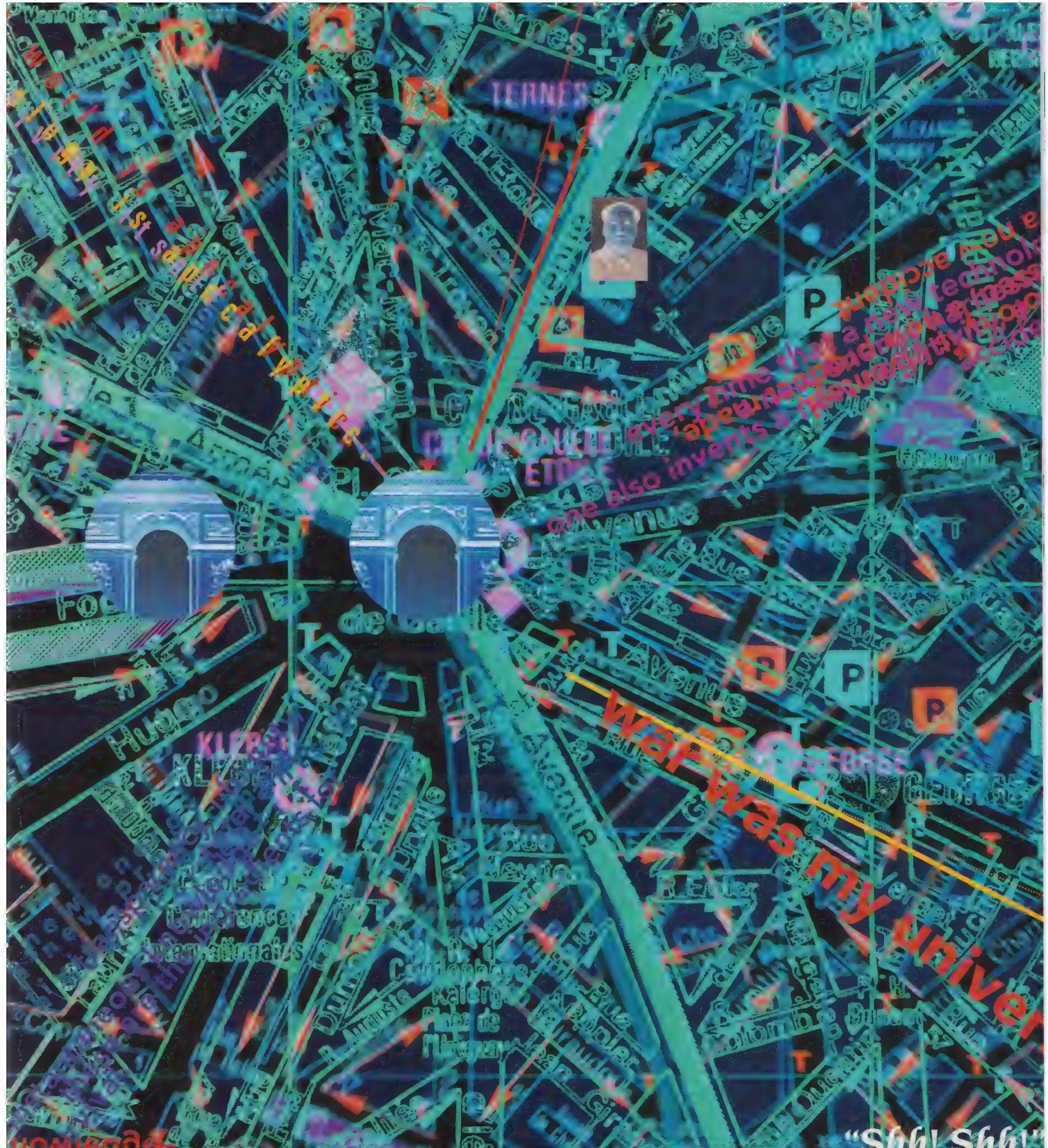
the very thickness of the planet and no longer

along its surface.

A target, probably a bunker, burns furiously as Allies storm the beach in Northern France on D-Day



VIVUS INDEPENDENT



CAN ONE THEORY EXPLAIN OUR EXISTENCE? IS THERE A THEORY THAT EXPLAINS EVERYTHING? THREE PHYSICISTS ARGUE THE STATUS OF THE BIG BANG, TIME TRAVEL AND GOD.

T H E O R Y O F

# Everything

by Phillip Adams



Will the Theory of Everything be discovered? As physics, and other sciences, traverse the worm holes of space and tackle infinity, the question seems to arise with increasing regularity. And, if the TOE is revealed, what would be the outcome for science?

Three scientists well equipped to tackle the question of TOE are Michio Kaku, Professor of Theoretical Physics at the City University of New York; Steven Weinberg, who picked up the Nobel Prize for physics in 1979 and the National Medal of Science in 1991; and Paul Davies, Professor of Theoretical Physics at the University of Newcastle-on-Tyne and Chair of Mathematical Physics at the University of Adelaide. The trio take some disparate views on TOE

**Phillip Adams: Is the TOE likely to give us the absolute final theory?**

**PAUL DAVIES:** I suppose that the physics community has a shared vision of what the complete theory of the world might be like, that it will be something with mathematical content, it would be aesthetically pleasing and it would be compelling on philosophical grounds. But, inevitably, you ask 'Must it be a particular set of propositions or statements or mathematical principles? Could it be otherwise?' It's very hard to imagine that we would have something which could only be a unique theory.

**Michio, how do you feel about the status of TOE?**



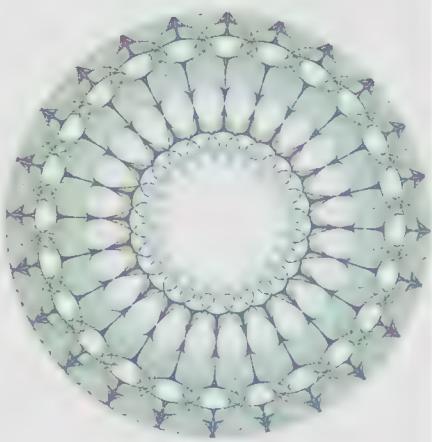
**MICHIO KAKU:** I'm putting my bets on the Superstring Theory – a Theory which is quite dramatic because it postulates a 10-dimensional universe. A universe in which these higher dimensions may actually vibrate; and perhaps light and nuclear force are nothing but manifestations of vibrations of a tiny string which is vibrating in a higher dimensional space time. Some people have scoffed at this theory, saying that it is almost *Twilight Zone* to believe that there are dimensions beyond the familiar dimensions of length, width and height. But with this very simple addition of higher dimensions and little strings vibrating in these higher dimensions, we have a very compelling picture that unites all four of the fundamental forces. Of course the theory cannot be proven, the superconductor supercollider (SSC) outside Dallas, Texas, was canceled by the U.S. Congress, but the SSC might have given us what are called superparticles, or echoes from this theory, the TOE.

**I understand that the superconductor supercollider was in with a chance?**

**STEVEN WEINBERG:** No, it's dead. We have about a third of a tunnel dug and there's not much you can do with a third of a tunnel, it doesn't go anywhere. Our best hopes now are that the European consortium called CERN will continue with the project they've started, which is sort of a junior version of the supercollider. Some of us in America are hoping that the U.S. will help to support the construction of that, although if it's hard to get congressmen to support building an accelerator in Ellis County, Texas, you can imagine how hard it is to get them to spend anything on an accelerator in Geneva, Switzerland.

**You've described the years since the mid-'70s as the most frustrating in the history of elementary particle physics.**

**WEINBERG:** Right. I agree with Michio Kaku, that Superstring Theory is a tremendous hope for the future. In some sense it is our only hope for the future, but at the same time it has been without success in predicting something which could be verified by experiment. The frustrating thing is the complete divorce between beautiful theories – which have enormous hope for where our field is going in the future – and experiment. It's been a terrible time, I don't understand how young physicists can cope with so little going on at the interface between theory and experiment.



**Now you need not a third of a tunnel but a 53 mile oval tunnel.**

**WEINBERG:** Yes, that's what the SSC would have been. We used to say carelessly that it was in Ellis County, Texas, but actually Ellis County would be in it.

**Big science is a bit unpopular at the moment isn't it, with governments around the world not willing to open the coffers?**

**WEINBERG:** That's right. Big science is also unpopular with other scientists who are practising at a smaller scale. One of the most distressing things I saw during the debate over the SSC was a large number of scientists, including physicists, testifying in Congress that the money would be better spent in their own fields. That's a natural reaction, except that there was not the slightest chance that the money saved by not building the supercollider would be spent in other areas of science.

**We are talking \$US 8 billion – an unimaginable amount of money.**

**WEINBERG:** Forty three one-thousandths of one per cent of the U.S. federal budget. Whether it would help the economy more or hurt it to build the accelerator is beyond the ability of economists to judge because it is such a small amount of money compared to the budget.

**Paul, Steven wants this piece of gear to validate beautiful theories. You are also deeply moved by beautiful theories – it's the driving force that informs all your books – so I guess it has to be built?**

**DAVIES:** I sincerely hope that something like this is built. It's possible that in this fallow time that experimentalists will come up with revolutionary ways of achieving the energies that are necessary for much less money. I'm depressed about the cancellation of the SSC because of the psychological effect that it has had on physicists. It means that the gap between theory and experiment is going to grow wider. That's never a healthy state of affairs in science because, ultimately, it's the experiments that are the arbiter.

**Imagine that the TOE is finally written on a blackboard at the University of Texas in Austin or at Harvard or Yale. What will happen to the human spirit?**

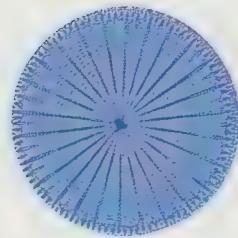
**WEINBERG:** We really can't say because we don't know what it is. To some extent the discovery of a final theory will end a certain kind of science. It won't end science in general, it won't even end physics, because there are thousands of things that it will not enable us to solve, like the theory of turbulence, or the stockmarket or next week's weather. There are lots of problems that are going to remain, wonderful problems in biology and psychology. Science will undoubtedly go on forever, but a certain kind of science that pushes back the outer frontier and keeps asking why, will end. It will be a little bit like the end of the era of geographical discovery on Earth. There's a certain sadness about it, because it's no longer possible to write a book like *Utopia*, about a strange country that no one happens to have discovered yet. They've all been discovered and there is a certain regret at a heroic age being over.

**KAKU:** Right, but there is a place you can go even after the North Pole has been totally mapped and that's outer space, into a third dimension, and one thing that the Superstring Theory opens up is the possibility of highly speculative things that normally were the province of crackpots. Now they are seriously discussed among physicists; for example, higher dimensions and the question of time-machines.

Time-machines are, in principle, possible. But you have quantum corrections that have to be carried out and a TOE would allow you to resolve whether black holes, for example, are dimensional gateways to other universes, or whether time-machines can bend time into a pretzel. So a TOE would give us a handle on resolving some of the age-old questions that traditionally have been the province of cranks and mystics and theologians, but now are a legitimate field of endeavor for theoretical physicists who are proposing rival blueprints for time-machines in the issues of *Physical Review*.

**Paul, what would TOE do to your old pal God?**

**DAVIES:** I see a TOE as the completion of the reductionist program, which was begun in Ancient Greece two and a half thousand years ago. The Greeks had the idea that the world, which is obviously complex, is, at rock bottom, just the combination of a few basic entities they thought of as atoms. We know that what we call atoms today are





actually composite bodies. Getting to some deeper, more basic level, a bottom level, a collection of primitive entities that can't be decomposed further, that you can catalogue and display for all its glory: that is the completion of this reductionist program. To complete that program and expose that underlying mathematical order in nature would be a glorious thing. To some people, the existence of that order suggests intelligence or purpose. To others, and Steven Weinberg will probably be in this camp, they look at that and say it is beautiful, it is inspiring, but so what? There is no evidence of purpose. The interpretation of that final result will be very much a matter of personal feeling.

**Steven, what is your feeling on that?**

**WEINBERG:** As we've gone further along this reductionist program that Paul mentions, many of the historic reasons for believing in divine intervention have disappeared. Before the birth of modern science it was difficult looking at the world, and particularly looking at human beings, to imagine that all this could have come about without supernatural intervention. As time passed, the work of Newton and Darwin showed how these things could come about. As we discover more and more I think we see less and less of the hand of God. Our discoveries are increasingly strange, esoteric, but impersonal, they don't show the signs of a guiding intelligence. That doesn't prove anything, and certainly a scientist can't say that he has looked for God and not found it and therefore that's the end of the story. But we don't see any sign of it and it's hard to imagine why anyone thinks we would. For me there is a certain nobility in confronting a non-human impersonal world and still making our own values, loving each other, enjoying beauty, pursuing science for that matter.



**So there is no experiment you've nutted out for your supercollider which is going to show us the face of God?**

**WEINBERG:** No. I think, if anything, it will show less and less of the hand of God.

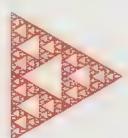
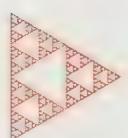
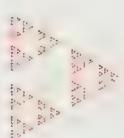
**Well, Paul, you don't accept this for a second.**

**DAVIES:** I think Steven is absolutely right, that you won't see the face or the hand of God in a supercollider or in any experiment. I want to be the first to say that when I use the word God, as I do only from time to time – because it's such a loaded term – I certainly don't have in mind any sort of super-being who is going to work miracles or interfere in the running of the world. I accept that science, and in particular physics, provides us with an adequate explanation of the world, and that this explanation is in terms of an underlying law-like order, a mathematical order. What intrigues me is where this mathematical order comes from and whether it's indicative of purpose or design. All these words are inadequate of course, but something along those lines, something that at least would give us a place in the world.

**You have a shy hope that God exists?**

**DAVIES:** Yes, I think most ordinary people use the word God to mean a sort of personal God, like the personal God of popular religion who can intervene in affairs, a God to whom you can pray and get things fixed up if they go wrong. I think that when physicists use the term God, and they do quite a lot incidentally, it is used in a sort of metaphorical way.

**WEINBERG:** I object to that actually. We should respect the meanings of words more than that. God has historically meant something, and when we talk about it we ought to keep some hand on what has been historically meant. What has been historically meant is some personality, some intelligence, that intervenes and to whom it is appropriate to pray. Other conceptions of God, like Einstein's conception of order and harmony in the world, seem to me to abuse the word. Why use the word if that's all it is? It makes the concept uninteresting to me.



**KAKU:** I agree with Weinberg that there are two gods. The God of Intervention, that is the traditional use that people pray to, and the God of Order that Einstein talked of. However, before the scientists get too smartalecky, there is a limit to what science can say because what happened before the Big Bang?

Theologians ask what happened before God created the universe? That same question



I don't want to dwell on God, but I want to pick up that point that Steven makes about using the term in its traditional or ancient sense. There's been a great many senses in which God has been used over the millennia, hasn't there?

DAVIES: Of course, and I would take issue with Steven there. Most of the theologians that I get to meet who take a 20th-century view to these things would have a conception of God that would, by Steven's definition, place them in the atheist camp. Their conception of God is of an abstract, underlying principle of order.

We're really missing the point of this debate, the issue to me boils down to this: That if we have some marvelous TOE, some complete description of the universe that we're satisfied with, the question is 'Is that the only possible theory or could it have been otherwise?' Whatever explanation you might have, as Michio was saying, that the universe might bubble out of nothing as a result of a quantum fluctuation, we don't need to explain what was there beforehand. We don't need a button-pushing God to set the whole thing off. The truth of the matter is that we would still be appealing to some underlying laws or principles to make all this happen. It is those laws and principles, that mathematical order, to which we should direct our attention. Now if it can be shown that there is only one possible, logical way in which that mathematical order could be, then there is nothing left to explain. But I've never been convinced by that, it seems to me that there are many possible worlds, many possible mathematical descriptions, many possibilities, many possible universes. Therefore, the question is; why this particular set of ordered principles which permit the existence of thinking, reflecting beings like ourselves. That's what to me seems the miracle of existence, it's not an interventionist miracle, it's just the miracle of the underlying order that is there in all existence. I find that very inspiring and suggestive of something like purpose, but it is far from the God of popular religion.

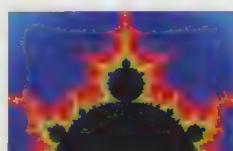
Steven, I know that theoretically the TOE will explain everything from the structure of a snowflake to cosmology, but what will it do, if anything, to explain life and consciousness?

WEINBERG: Before I take that up, I'd like to respond briefly to Michio and Paul's comments. When Michio describes this boiling universe in which our Big Bang was just a little bubble, I think he's referring to work that was initiated by Andre Linde, now at Stanford. I find this a very attractive picture and it has good theoretical basis, absolutely no experimental support so far, but certainly worth thinking about very seriously. An important implication is that there wasn't a beginning; that there were increasingly large "big bangs," so the universe goes on forever – one doesn't grapple with the question of it before the Bang. The universe has just been here all along. I find that a very satisfying picture; it offers the possibility of explaining why things are the way they are in terms of stability, because it's a fluctuating equilibrium.

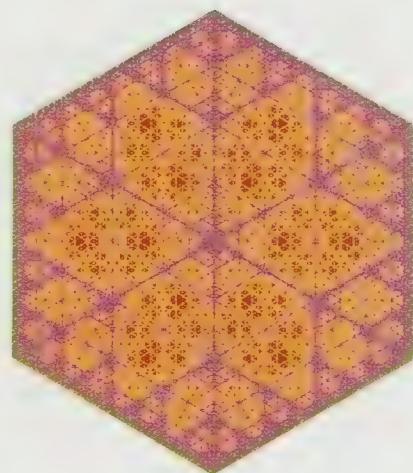
Going back to the use of the word God, I agree that there are many theologians who, confronted with the absurdity of some popular conceptions of God, have refined the conceptions so much that it no longer bears much resemblance to that popular conception. I deplore that as well.

You see that as opportunistic?

WEINBERG: Exactly. There is a tremendous anxiety not to be seen to be without God and this motivated Einstein also. One should be more honest about this and say that if it is not the popular God to which people have prayed over the millennia, then it is something else so different that it's not worth that name and we should not use that word. I guess arguing about what words you should use is in the end fruitless.



bedevils scientists, because we have to ask where did the Big Bang come from. The Quantum Theory of the Universe says that things are necessarily unstable and perhaps even a state of nothingness was unstable and nothingness began to bubble and boil and these bubbles began to expand rapidly, each creating a small universe that expanded, creating what is called the Big Bang. So in some sense our universe may just be a small bubble in a much larger cosmic nothing that happened before the Big Bang. So this new TOE, the Superstring Theory, the Quantum Theory of the Universe, gives us a handle that what may have happened even before the instant of creation, that in some sense there could be other universes out there.





They may be fruitless, but it's also the biggest argument that human beings can possibly have. I would have thought that while Steven's right, Paul, that theologians are opportunistic, the word God as you use it is an exciting idea, because it is not in any sense the old-fashioned God or any of the ones that are currently on offer.

DAVIES: It's certainly not. We always end up talking about God. I guess that the fascination that a lot of people have for science in general, physics in particular, is because it deals with the fundamental issues; they're hoping it will illuminate their own existence, their place in the universe.

Then characters like you come along stirring the possum, as they say in Australia.

DAVIES: Well inevitably, because I have found over the years in lecturing on straight scientific topics that the questions at the end always seem to get back to this issue of 'Is there a meaning? Is there a purpose? Where do we fit in? Is there a God?' I don't think that science can readily answer these things, but it's quite clear that people expect us to address them.

And not even the TOE will answer these things?

DAVIES: A TOE that could somehow be proved to be unique might just end the whole argument, but I don't think that that is going to be the case. We might have a compelling TOE, but it could be put alongside a lot of others that we might regard as ugly. Otherwise, human beings will always want to ask why it is as it is.

KAKU: I believe that God, whatever he is, may not have had a choice in creating the universe, as Einstein himself speculated. There are no competing theories so far to the 10-dimensional Superstring Theory. All other theories can be shown to be mathematically inconsistent and therefore junk.

WEINBERG: I disagree with that. Take the theory of the so-called strong interactions, Quantum Chromodynamics. It is a completely consistent theory.

KAKU: But it has no gravity, therefore it's a useless theory by itself.

DAVIES: No, but it describes a possible world doesn't it?

WEINBERG: But it describes a perfectly possible world.

KAKU: But it's not our world.

DAVIES: No. But then we can ask the question, 'Why do we have the world that we do, why not some other world?'

KAKU: Because if you go back to the analogy that at the beginning of time we had a state of nothingness and things were boiling in it, you have two basic ingredients, one of these is the quantum and the second is the question of space. When you merge Quantum Theory with the Theory of Space, that is, curved space, then you have to rule out a theory of just strong interaction.

WEINBERG: I'm sorry, why do you have to have the quantum, why not classical mechanics?

KAKU: Because classical mechanics cannot explain the stability of our universe. Given the fact that atoms would collapse in a classical universe.

WEINBERG: No, I think you're being much too narrow-minded.

KAKU: I don't think so. The point is that God may not have had a choice in creating the universe.

WEINBERG: No, I'm describing choices he might have had, he might have, to create a universe described by Newtonian mechanics in which there are no atoms, there are just point particles endlessly orbiting each other forever.

KAKU: Well, let me rephrase it. He may not have a choice in creating our universe.

WEINBERG: Ah, that's something very different.

DAVIES: Ah, that's a different matter.

KAKU: But that's what we're talking about, that's the whole bottom line, our universe.



**WEINBERG:** There is a sense in which Michio may be right, but it's a much more limited sense. There may be another universe that has a set of laws which are similar to ours, but slightly different. It may be that the final theory that we will discover, although not unique, is not adjustable in any way; that there will be no change you could make which would lead to a mathematically consistent theory. It may also be, and this fits with what Michio says, that it is the only theory which is rich enough to allow for the possibility of gravity, life, stars, atoms. Those might be shown mathematically but there will always be some irreducible question left – why?

**KAKU:** But the point I'm making is very simple, we want to describe our universe with the richness of diversity that we see around us. That's why Einstein asked the question: did God have a choice in making our universe? Not whether or not God had a choice in creating barren universes where things collapse and are unstable, like a Newtonian universe which is basically unstable. Our universe is quite stable and to create such a universe we start with two basic ingredients; space, curved space, and the quantum theory. To merge those two ingredients may require a theory of hyperspace; 10-dimensional strings which combine these two ingredients of space and the quantum.

**WEINBERG:** I suspect that Superstring Theory is the only way of resolving those, although I don't understand why you keep emphasizing the 10-dimensional aspect. It seems to me that as Superstring Theory has evolved we've gotten away from thinking of 10 dimensions as really being fundamental and the point of view that's taken today is that what's really fundamental are certain consistency conditions, so called conformal symmetry.

**Paul, would a TOE have to explain consciousness, just as it explains a snowflake?**

**DAVIES:** The sort of TOE we've been talking about would not be addressing the theory of consciousness, I would be astonished if something like Superstring Theory told us anything about complex systems, and certainly not systems as complex as the human brain. However the nature of consciousness is one of the great unsolved problems of science and science will one day explain consciousness. We will understand how mental phenomena interface with physical phenomena. We've got a long way to go yet.

**Steven, given that you can't have access to your \$US 8 billion gadget, is it the beauty of theory which makes you feel confident?**

**WEINBERG:** Yes. It's difficult to describe just what that beauty consists of. It's a certain simplicity, but even more than that, there's a compelling quality that you cannot change it in any way without the theory falling apart, becoming absurd. That is mostly what makes up a beautiful theory and in this respect a beautiful physical theory is a little bit like a beautiful sonata that gives you the sense that no note could be sounded differently. If we discovered a final theory and it turned out not to be beautiful, none of us would call it a final theory; we would say there must be something more beautiful at the bottom of this.

**It's a beguiling idea, isn't it? That the final theory has to be elegant, it has to be beautiful. But it's a beauty that only you guys can comprehend.**

**DAVIES:** This beauty tends to be expressed in mathematical terms and most people are afraid of mathematics. It's very hard to communicate the subtlety of the beauty that we're talking about – and yet it's obvious when you're in the subject. There have been several episodes in the history of theoretical physics where the way forward was really chosen on grounds of some elegant, mathematical beauty and it turned out to be right. Whether this is just a historical accident, or points to something deeper in nature, I don't know.

**Michio are you persuaded that a theory has to be truly beautiful to be valid?**

**KAKU:** Yes I am. That's what motivates physicists psychologically to work on these things. Beauty is simplicity and symmetry, and the symmetry of a snowflake is a reflection of a spatial symmetry that is a subset of the symmetries of the theories of the universe. So we think that the TOE must have been perfectly symmetrical. There must have been incredible symmetries at the instant of the Big Bang, so when we see the symmetries around us, we may actually be seeing remnants after 20 billion years of the perfect symmetry that may have existed at the instant of the Big Bang. Because the world around us has to be broken and the symmetry around us that we respond to at an emotional level is a subset of the symmetries of the TOE. ■



WITH ITS EMPHASIS ON DESTRUCTION AND DECAY, CHAOS THEORY HAS CREATED A SENSE OF HOPELESSNESS AND DESPAIR INSIDE AND OUTSIDE THE SCIENCE COMMUNITY. BUT THE STUDY OF COMPLEXITY MAY RE-ESTABLISH THE VIEW OF NATURE AS ESSENTIALLY CREATIVE AND RESTORE THE IMAGE OF SCIENCE AS A HUMANIZING ACTIVITY.

# 4.6692016...

The goal of every scientist is to explain the world. This can, at first, seem a hopeless task: the real world is so complicated, so intricate, so mind-bogglingly perplexing that it seems unlikely we could make much progress. Two Greek philosophers, Leucippus and Democritus, did make an early advance: they suggested that everything in the physical universe was made up from a few basic building blocks, or atoms. They claimed that every physical system, however complex, is nothing but an elaborate concoction of atoms, while every physical process is nothing but the rearrangement of atoms. This "reductionistic" reasoning provided a powerful scientific methodology; but nowadays we know that it is an austere account of reality that seems peculiarly inadequate.

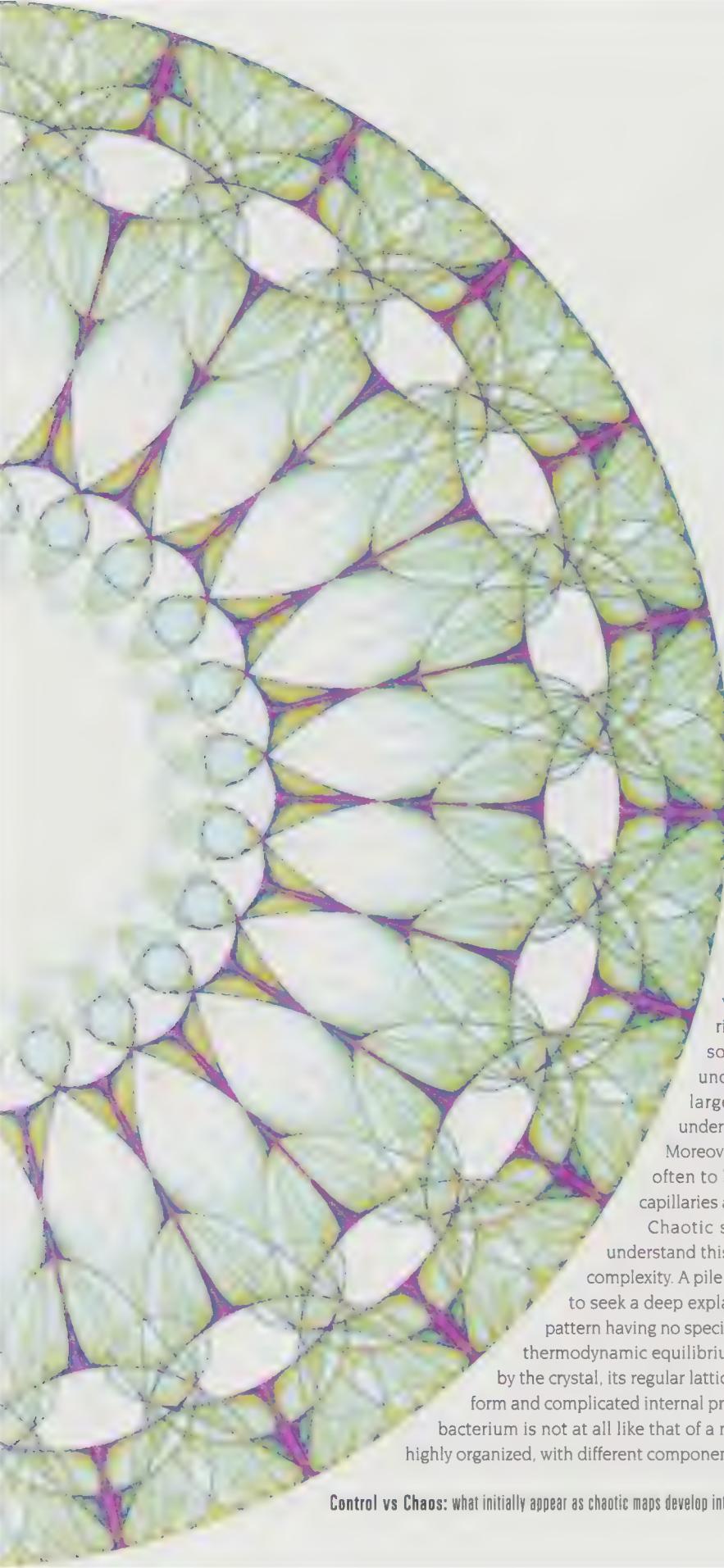
A fully satisfactory theory of the world would surely need to explain why, given the limitless number of ways in which atoms might arrange themselves, they actually come together to make the distinctive forms and systems we habitually observe. Why does the world contain galaxies and clouds, snowflakes and cyclones, trees and people? The universe abounds with complex systems: star clusters, planetary rings, turbulent rivers, cloud patterns, termite mounds, brains, immune systems, ecosystems, economic systems... the list is endless. Can science illuminate the nature and origin of all this complexity?

Until recently, attempts to explain the origin of physical complexity were almost entirely restricted to biology. Darwinian evolution through random variation and selection is an important part of the picture, but it cannot tell the whole story: there is no gene for a snowflake or the great red spot of Jupiter, for example. So how else may complexity emerge in nature?

**Predicting chaos:** as systems become more chaotic they employ a mathematical constant akin to  $\pi$ , known as 'Feigenbaum's number', which is named after the mathematician who discovered it — Mitchell Feigenbaum. Feigenbaum's number is 4.6692016.

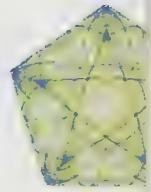
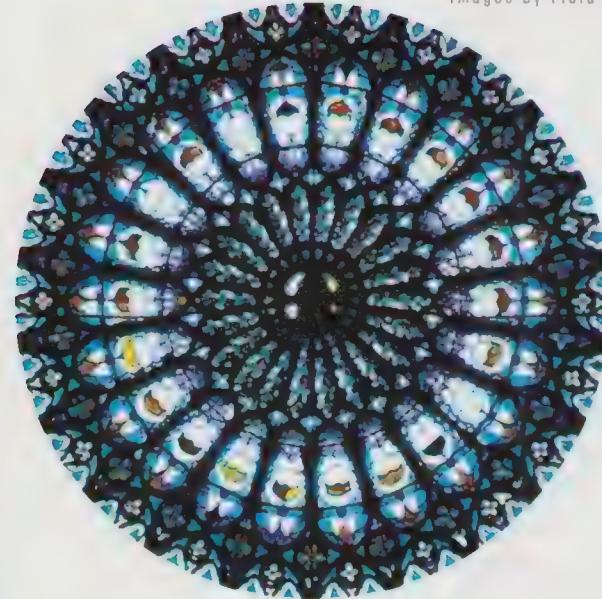
Oxford University Press: Symmetry in Chaos





by Paul Davies

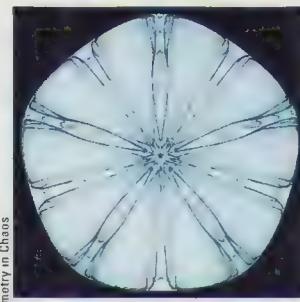
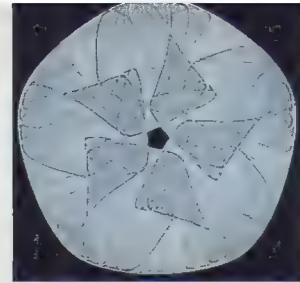
Images by Field and Golubitsky



Recent inspiration has come from Chaos theory – systems often behave in an essentially random manner, even though they are deterministic. The yearly variation of insect populations, the motion of the double pendulum, the trail of rising cigarette smoke – these are classic examples. Each can be predicted with some accuracy at a small, controlled level; the functions can be described and understood in great detail. But each behaves in an essentially random manner in larger systems. Scientists have found that there is a type of order in this chaos; underlying mathematical patterns that are common to widely different chaotic systems. Moreover, the distinctive fractal structures associated with the mathematics of Chaos are often to be found in nature – the spatial arrangements of tree branches, fern leaves, capillaries and bronchioles, hoar frost, chemical deposits and many other objects.

Chaotic systems, while ubiquitous, are complex in a somewhat primitive way. To understand this point, it is necessary to draw a distinction between organized and disorganized complexity. A pile of buttons tipped on the floor makes a complex pattern, but it would be a mistake to seek a deep explanation for the arrangement we see. The buttons are scattered at random, their pattern having no special significance. The emblem for this sort of blind, disordered complexity is a gas in thermodynamic equilibrium, its molecules rushing about chaotically. The opposite extreme is symbolized by the crystal, its regular lattice a model of simple mathematical order. Now consider a bacterium. Its elaborate form and complicated internal processes make it a far cry from the crystal. On the other hand, the complexity of the bacterium is not at all like that of a random gas. Unlike the gas, or the pile of buttons, the bacterium's complexity is highly organized, with different components of the system cooperating to make a coherent unity.

**Control vs Chaos:** what initially appear as chaotic maps develop into symmetrical images that often have precedents in nature.



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#### Symmetry in Nature:

Two sets of images displaying comparable symmetry, the computer-generated flower and sanddollar and the St John's Wort and Starfish respectively.

#### Sierpinski Triangle (centre-right):

The triangles are based on a random selection of points on an equilateral triangle, that when repeated creates a system of regularity. Symmetry is created from chaos.

The Sierpinski Pentagon (opposite page) is created in a similar way.

It is not hard to see how chaotic complexity could emerge in nature – but explaining the widespread existence of organized complexity presents a much tougher challenge.

Organized complexity is not restricted to biology. Many physical and chemical systems will, when driven far from equilibrium, spontaneously produce complex organization. My favorite example is heating a fluid from below, such as water in a pan. At first the water is in a featureless state of uniform simplicity, but as the temperature gradient rises, the fluid starts to convect. Trillions of molecules move in unison, as if guided by an unseen hand. But there is no hand, no control, just purposeless forces acting between neighboring molecules. If the heating is done carefully, a distinctive convection pattern emerges, in the form of regular hexagons, presenting the appearance of a honeycomb when viewed from above. This kind of randomness is also a kind of order that allows scientists insights into the nature of complexity.

The complexity of a hexagonal convection cell pattern is admittedly not very elaborate, but its formation is typical of the way that far-from-equilibrium systems may leap spontaneously into new, more highly organized, complex states. The Belgian chemist Ilya Prigogine has been influential in drawing attention to the significance of such abrupt spontaneous transitions, describing them as self-organization. By producing order out of chaos, self-organization contrasts with the normal tendency for matter to degenerate from order into chaos, in accordance with the second law of thermodynamics.

Significantly, self-organizing systems tend to display chaotic behavior too. The physical conditions necessary for these two phenomena are similar, involving non-linearity and feedback amplification. Thus a convecting fluid, if overheated, will boil chaotically. Recently, scientists have identified a regime dubbed “the edge of chaos” where a system will exhibit a sort of “free will,” exploring a rich repertoire of complex behavior in a largely unpredictable way, but without descending into the blind, groping anarchy of total chaos. Some scientists think that biological evolution – and even the conscious sense of freedom that humans enjoy – are related to edge-of-chaos phenomena. Creative activity at the edge of chaos could be the principal route whereby nature spontaneously generates novel complexity, with seemingly uncanny efficiency.

The systematic study of complexity took off with the advent of fast computers, which enabled scientists to simulate complex behavior on their screens. Longstanding topics like biodiversity, fluid turbulence and fluctuating share markets have all been

tackled. These extensive studies have hinted that there may exist quasi-general “laws of complexity” that apply to a broad range of disparate systems. One area where such laws may have been glimpsed is in what are known as “adaptive systems.” These are when a complex system can react spontaneously to changes in its environment; crudely speaking, it can “learn” and respond in a manner suggestive of goal-seeking. Examples of adaptive systems – apart from the obvious case of people and human societies – are ecologies, economies, neural networks (used in computers), ant colonies and the mammalian immune system.

The first step in establishing a true science of complexity is to find ways of quantifying it. A crude measure of the complexity of a physical system is the amount of information needed to simulate or describe it; alternatively, it can be measured by the quantity of information the system contains. Thus a simple system such as a

uniform fluid or a crystal can be described using very little information, while the topography of a continent, which requires thousands of detailed maps, is highly complex. However, raw information alone makes no distinction between organized and disorganized complexity. The state of a gas in thermodynamic equilibrium certainly encodes a vast quantity of information (the positions and velocities of all those randomly arranged molecules), but the information has little “value.”

There have been numerous attempts to capture the elusive quality of organization. We recognize it in the real world, but it is notoriously hard to pin down mathematically. Most attempts

**Why does the world contain galaxies, clouds, snowflakes, cyclones, trees and people? The universe abounds with complex systems; can science illuminate the nature and origin of all this complexity?**



**Scientists have found that there is a type of order in the chaos of the world; underlying mathematical patterns that are common to widely different chaotic systems.**

involve some aspect of the theory of computation. Charles Bennett of IBM’s Watson Research Center has suggested that complex organized systems such as living organisms are characterized not by information content *per se* but, roughly speaking, by the amount of labor involved in processing the information. The genetic information content in human DNA, for example, didn’t simply appear suddenly one day. It is the result of a long and complicated sequence of evolutionary steps, each of which refines and discards information. To recreate those specific steps would involve an enormous amount of information processing.

Bennett suggests that a useful measure of complexity is something called “logical depth” – defined as the execution time of the most concise computer algorithm that can generate or faithfully simulate the system in question. A related concept is that of thermodynamic depth, developed by physicists Heinz Pagels and Seth Lloyd. This is defined in terms of the amount of entropy produced during the systems’ evolution to its present

state, and is an alternative measure of the amount of labor involved in creating the system. Many other definitions of complexity have been suggested.

One of the attractions of complexity theory is the way in which experience in one field can provide insights into another. Take the case of neural nets. In essence, these are networks of wires and switches. Electrical pulses course around the circuit. The currents travel down the wires, merge at the switches and, depending on the strength of the signals, the switches can be flipped. In this way, the circuit layout keeps changing in response to the electrical activity flowing around it, the feedback creating patterns of electrical activity that may shift unexpectedly, or settle into stable cycles. Neural nets, as the name suggests, are intended to mimic the operation of the brain. In practice, such networks are simulated on digital computers. A distinctive feature is that a net can learn from experience, and be "trained" to perform tasks in an optimal manner.

Early on, neural nets were applied to spatial pattern recognition, and as a model for associative memory, but in recent years they have been applied to fluctuating financial markets to help investors gain an edge on their competitors. Nor is this the only technique investors have borrowed from complexity science. Genetic algorithms are another. These are computer programs that can be randomly modified by cutting and splicing – much as genes are shuffled and combined through sexual reproduction. Such algorithms can efficiently explore the parameter space of the problem of interest, such as predicting the gold price, and seek out peaks of adaptive success.

Many complexity theorists have been attracted to a field known as artificial life. As the name suggests, this is an attempt to capture the essential characteristics of biological organisms in the form of computational games – in essence, mimicking life inside a computer matrix.

An early example, called "The Game of Life," was invented by Cambridge University mathematician John Conway. It consists of a finite checkerboard of pixels, or picture elements, each of which may be empty or filled so as to make a pattern on the screen. A set of rules is then used to change, or update, the entire pattern in a stepwise manner. The rules determine whether each filled-in element remains filled or is vacated, and whether each empty element remains empty or is filled, according to the number of neighboring elements that are filled. In this way, the initial pattern will generally change. The process is repeated again and again, and the evolution of the patterns are studied. Conway's game is an example of what is known as a "cellular automaton."

and it has thrilled a generation of computer buffs. Random input can produce a whole menagerie of life-like forms that cavort about the screen, sometimes attacking and destroying other forms, reproducing, creating new forms and so on.

Not only do artificial life games have a high entertainment factor, but they also raise deep questions about the minimal level of complexity required by self-reproducing entities and the underlying computational nature of living organisms. The subject has spawned a vast literature of mathematical theorems that try to elucidate the logical and mathematical basis of biological complexity. Artificial life studies have cast light not only on the nature of biological organisms, but on ecosystems, the problems of biodiversity, and evolutionary adaptive change too.

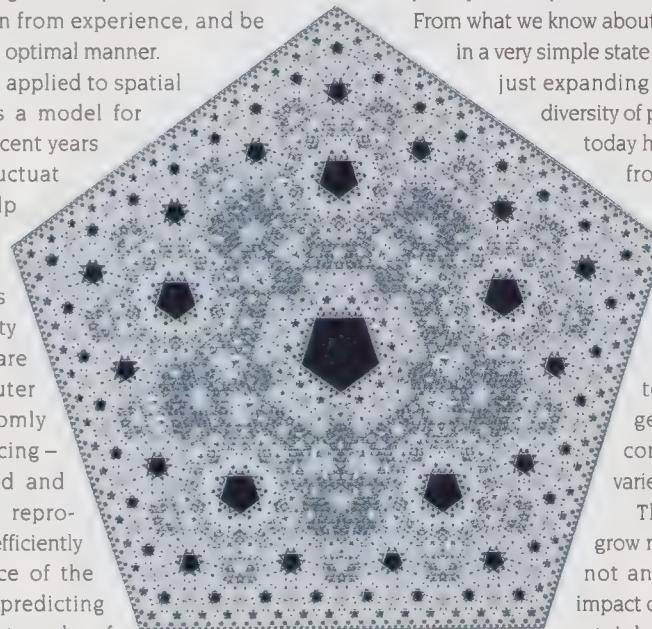
One of the great challenges to the emerging science of complexity is to explain the so-called "arrow of time" problem.

From what we know about the Big Bang, the universe began in a very simple state – perhaps a uniform gas or maybe just expanding empty space. The richness and diversity of physical forms and systems we see today have emerged since the beginning from a long and complicated sequence of self-organizing and self-complexifying processes. The evolution of life on Earth, starting with primitive microbes and progressing to the highly evolved state of the ecosphere today, is just one example of a general trend from simple to complex, from featurelessness to variety.

The tendency for the universe to grow more complex with time is clearly not an absolute law of nature – the impact of a large asteroid on Earth would certainly set back the cause of organized complexity dramatically – but it does seem to be more than an accidental trend. Of course, if you start with the simplest state, it

can do little else but grow more complex. But there is no guarantee that this complexity will be organized. The hope is that the study of complexity will expose some general mathematical principles – principles of organization if you like – that will explain this uni-directional trend towards organized complexity scientifically.

For 150 years, science has been dominated by the paradigm of the second law of thermodynamics – the tendency for physical systems to degenerate into chaos. Much of the anti-science feeling today stems from the sense of hopelessness and despair implied by this law, with its emphasis on destruction and decay. If the study of complexity uncovers a natural progressive tendency that runs counter to the second law (without contradicting it of course), it will re-establish the ancient view of nature as essentially creative and hospitable. It may even help restore the image of science as a humanizing activity. ■



Sierpinski Pentagon (above) is created using algorithmic repetitions of pentagons, which form a system of regularity.

Francis Crick uses models of neural nets in relation to working out how our consciousness works.

**The emblem of chaos:** many people consider the the Mandelbrot Set to be the most complex object in mathematics.



W L L T O

HAVING DISCOVERED THE BASIS OF LIFE, FRANCIS CRICK'S LATEST TARGET IS ONE OF THE HOLY GRAILS OF SCIENCE:  
HOW THE BRAIN FUNCTIONS, THE PROBLEM OF CONSCIOUSNESS, AND EVEN THE SEARCH FOR THE SOUL.

by Julian Brown

Imaging by Christopher Waller

**The triangle of deception:**  
What you see is not what is really there but what your brain believes is there. Named after the Italian psychologist Gaetano Kanizsa, the Kanizsa triangle creates illusory contours that makes the triangle jump out from the rest of the page and appear whiter.

"I HAVE NEVER SEEN FRANCIS CRICK IN A MODEST MOOD" WAS HOW James Watson provocatively began his best seller, *The Double Helix*, a frank and vibrant account of one of the greatest discoveries in science. In 1953 Watson and Crick discovered the structure of DNA, the material that constitutes the genetic basis of life. It was an achievement that won them the Nobel Prize and made them one of the most famous double-acts in scientific history.

One might conclude that Crick had little to be modest about. Yet many people have remarked that Watson's description of Crick gave totally the wrong impression of the man. Far from being an insufferable loudmouth, Crick, today at least, is a gracious and courteous man who speaks with humility and a delightful sense of humor. Aged 78, with a shock of white hair, Crick has the air, as one newspaper article aptly put it, of a kindly, wise uncle ready for a chat with a favorite niece or nephew – a sort of "Wilfrid Hyde-White" of science. But perhaps everyone misinterpreted Watson's opening line, unfortunate though it was. It isn't that Crick lacks modesty it's just that he's so irrepressibly exuberant. It is his unflinching nerve to confront the big questions of science that has been without modesty.

Born and bred in England, Crick has spent the last 20 years of his life in America working at the Salk Institute for Biological Studies, which sits on a sun-drenched site near San Diego in Southern California overlooking the Pacific Ocean. Appointed a few months ago as the president of the Salk Institute, he remains amazingly active. The subject of his study there has been the most complex entity in the known universe: the human brain. Over these past two decades he has produced some remarkable ideas including theories about memory, free will, attention and the function of dreams. Many of them have provoked controversy and excitement, marking him out as a leading figure in brain research. Yet this was a field Crick came to when most people would be thinking of taking retirement.

"I was 60 and was invited to the Salk Institute for a sabbatical," he says. "I had always wanted to do neuroscience and after a while the then president persuaded me to stay. So I decided that I would switch fields permanently. It took me a few years but during that time I remember the editor of *Scientific American* asked me to write an article about the brain essentially because I knew nothing about it! That's how I started."

Francis Crick has traveled over a vast intellectual distance in his life. His move into brain science was the second time in his career he had made a complete break with his past. His beginnings were hardly auspicious. He gained "a rather old-fashioned degree in physics from University College, London. Unfortunately, we didn't do much quantum mechanics which was what made the subject so interesting then. With the war I found myself doing engineering, assisting the weapons industry developing electrical circuits for magnetic mines."

After the war, Crick realized that he hadn't the training to become a theoretical physicist and that experimental physics would depend upon very large teams. So he took his chances and switched into the fledgling field of molecular biology. Five years later, despite a reputation for fast thinking and clever insights, he still hadn't got his Ph.D. – much to the combined amusement and disapproval of his colleagues at the Cavendish Laboratory in Cambridge. His career seemed to be going nowhere fast.

# DISCOVER



Original Photography: Pierre Perrin

**Consciousness Razing:** Neurons alone do not explain how the brain functions. It operates through a complex series of interactions. One such example of interactivity Crick examined is how humans perceive the world.

And then Jim Watson, a 24-year-old American post-doctorate from Indiana University, walked into his life. Two years later they had cracked the secret of life. It is a famous story not least because of Watson's 1968 book. Crick himself penned his own reflections on the affair and his subsequent work some 10 years ago in *No Mad Pursuit*.

The BBC made a superb TV film about the dramatic events that led up to the discovery. It's a wonder that the story was not turned into a movie for the big screen. Crick was not totally averse to the idea. "We were friendly (and still are) with a Hollywood

producer who wanted to make a major movie. But I told him that I didn't think it was suitable because there wasn't enough sex and violence! Nevertheless, he did produce a film script and we got paid but as it turned out the backers didn't like it because, just like I predicted, it didn't have enough sex and violence in it."

One reason why the discovery of the structure of DNA was so important was that it immediately showed how genes can replicate. The beauty of the double helix structure is that it consists of two copies of the same information enfolded together in a perfect geometric spiral. To reproduce, the molecule can

unwind into two strands, each of which becomes a template on which a new strand can be assembled. To this day the structure remains an awe-inspiring sight. The discovery also opened the way to understanding how genetic information is stored. During the next 12 years Crick and others managed not only to decipher the genetic code but also to elucidate the details of the cellular machinery that translates DNA sequences into proteins, the building blocks of all living cells.

ONE OF CRICK'S EARLIEST FORAYS INTO BRAIN RESEARCH WAS A NEW THEORY OF DREAMS. IT WAS BASED UPON IDEAS THAT WERE EMERGING FROM THE RAPIDLY DEVELOPING SUBJECT OF NEURAL NETWORKS, COMPUTER SIMULATIONS OF NETWORKS OF NERVE CELLS.

This work culminated in 1966 with a major conference at the Cold Springs Harbor Laboratory in New York State, now headed by James Watson and one of the leading centers in the race to sequence the human genome. Crick recollects the occasion well. "It was my 50th birthday and they organized a cake with 50 candles on it. It came in a huge box. I pulled the strings and a lady came out. That's why I remember it! But within the following year or so it was clear that we had got all the essential ideas about the genetic code right."

Crick's work on DNA and the genetic code formed the foundations on which a vast industry has been built. Molecular biology and biotechnology have led to so many developments in medicine, pharmaceuticals and basic biology that it is hard to overestimate the importance of that early work. But Crick is quick to emphasize the role of later contributions. "It was the second revolution of manipulating recombinant DNA and rapid DNA sequencing that led to biotechnology. People tend to forget that. It wasn't just this one revolution of finding the structure of DNA. Without the later work we would not be having all the developments we hear of today."

After cracking the genetic code, Crick spent 10 years working in developmental biology. Here the quest was, and is to this day, to find out how different cells in the body switch on and off their genes. All cells in the body contain the same genes, and yet some cells turn into muscle, some turn into skin, some turn into nerve tissue and so on. How do the genetic programs control these different developmental pathways? The answer is proving a lot harder to find partly because there seem to be so many mechanisms. In 1976, Crick, sensing that the field required new techniques and new approaches, decided to follow a calling to do something else. As ever with an eye for the big problems in science, he was attracted to the study of the brain, possibly the greatest of all quests in biology.

So at the age of 60, Crick moved to California and began his new adventure. What started out as a short break turned into a permanent preoccupation. Last year he published his book *The Astonishing Hypothesis: The Scientific Search for the Soul* which distills the essence of many of the ideas he's been working on over the last two decades.

His ultimate target is that holy grail of science: the problem of consciousness. The reason that it is a problem is that no-one can figure out how consciousness comes about. How is it that an organ that looks like a lump of porridge is able to experience pain and pleasure, memories and ambitions, and be responsible for the creative acts of the likes of Leonardo da Vinci, Beethoven and Einstein? And how is self-awareness achieved? If you made a computer program aware of its own progress, would that count as self-awareness?

Crick's "Astonishing Hypothesis" is that all of these extraordinary features of the brain are the result of biochemical and electrical processes occurring within the nerve cells of the brain. Ironically, Crick does not think the hypothesis is astonishing at all. For an atheist, after all, what else is there in the brain that could be responsible? "No, I don't think it is amazing in the slightest, nor do most of my colleagues in the neurosciences. But don't forget, 70 per cent of people in America believe there are angels, according to the surveys I've read. They, presumably will find this hypothesis astonishing."

One of Crick's earliest forays into brain research was a new theory of dreams, which he developed with Graham Mitchison, a colleague at the Salk Institute. It was based upon ideas that were then emerging from the rapidly developing subject of neural networks, computer simulations of networks of nerve cells. Crick and Mitchison had become aware of the phenomenon of overloading in such networks. If you try to make the networks learn too much information, they have a tendency to become unstable. In some cases the result was parasitic oscillations. Crick and Mitchison's idea was that perhaps dreams were the brain's way of preventing such neurological overloading. To put it crudely, each night as we dream, the brain is switched into a kind of unlearning mode. The brain then runs a semi-random program of excitations which are then unlearnt – a process which helps to clean out any signs of instability.

It has to be said that Crick's sudden entrance into a subject with which he had not been long involved ruffled a few feathers. Sleep researchers and psychologists have been trying to fathom the mysteries of dreaming ever since their subjects were invented. Who did this newcomer think he was to presume he had the answer? Even the editor of *Nature*, the scientific journal that published Crick's research, commented that the paper he had received from Crick was embarrassing in its naivety, a strange comment in view of the fact he went on to publish it.

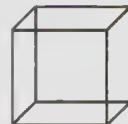
Fifteen years on, the theory has been neither proved nor disproved. Obtaining the requisite experimental evidence in brain research is one of the hardest things about the subject. Crick freely admits the theory was very incomplete and rather simple. "I think we rather suffered from coining the slogan 'You dream in order to forget.' That caused all sorts of misunderstandings because some people came up and said 'I dreamt about my grandmother, but I haven't forgotten her!' Now we try to say 'We dream in order to sort out memories that have become confused.' Freud pointed out there is a process known as condensation in dreams. If you dream about your friend Charlie it'll usually be a mixture of several people who may resemble

You can't fool all of the people:  
The brain processes visual information in different ways. Part of the visual task is to recognize shape, color, motion, distance. The image of Lincoln is perceived when the brain combines many of these clues. With blurred vision, or by standing several meters away, the image can be recognized more clearly.



Charlie. Freud noticed this in his famous patient Irma. If you have an overloaded neural net, that's what the nets do."

*The Astonishing Hypothesis* dwells less on intangible ideas such as dreams and concentrates on the one area of the brain that has been studied most intensively: the visual cortex, the area of the brain responsible for processing what we see. The business of seeing, Crick argues, is intimately connected with our consciousness. A classic example is that of the Necker cube, a wireframe version of a cube. If you stare at it for a while you will see the 3D shape of the cube invert. After a time it will switch back again. The brain is uncertain which version it prefers. Another example, also from Crick's book, is an image of a well-known face that has been obscured by a process known as pixellation. (Abraham Lincoln in pixels). Close up the image may not make much sense and yet, held several meters away, the picture becomes readily recognizable. These and many other visual puzzles offer important clues as to what the brain does when it processes visual information.



Throughout his book Crick offers both his and many other people's insights into what the brain must be doing. In recent years great progress has been made in finding out how different regions of the visual cortex are wired up. So much so that it is possible to draw a primitive kind of circuit diagram of the cortex – albeit a monkey's cortex rather than a human's. What this reveals is how the brain breaks down the task of seeing into a series of different processes, each of which passes on information to other regions of the brain.

Much excitement has focused on the discovery of nerve cells that are specifically excited by features of the world we see. Some cells, for example, may respond only to horizontal lines, others to vertical lines. Deeper inside the system, researchers have found cells that respond strongly to faces. The question people like Crick want to answer, though, is at what stage do we become conscious of what we see? Where in the circuitry does the whole system become self-aware?

"Some people talk about awareness neurons. We don't know whether such neurons really exist, but if they do we can give pretty strong theoretical reasons why they must be distributed over a lot of different levels. They can't just be in one place. On the other hand we know there are regions which aren't correlated with our subjective experience. So awareness seems to be distributed a funny way."

Of particular interest are some of the reverse connections found between the higher systems of the brain and earlier stages of visual processing. What do these do? Also what precisely is the role of the thalamus, an organ within the brain that seems to act as the gateway for all inputs into the cortex, the thinking part of the brain? Finding out the answers to these and many other problems in brain research remains a massive task. The cortex takes the form of a complex folded sheet, and beneath each square millimeter of cortex there lies no less than 100,000 neurons. Some of them are connected mainly to neighboring cells but others travel over much longer distances to connect to other parts of the brain. Although scientists have an outline of

how some of these are interconnected, it appears to be far more chaotic than anything you would find on a computer circuit-board.

Much of Crick's work has been to consider the results of other people's experiments and make suggestions and hypotheses. In his quest for the holy grail of brain research, the key to consciousness, Crick's book contains an intriguing postscript on free will. In this he succinctly elucidates how a machine such as the brain can seem to have free will – even though at the lowest molecular levels it may not be free at all. He recalls speculating on where one might expect to find Free Will in the brain and suggesting that it would probably receive outputs from the higher sensory systems and feed into the higher planning levels of the motor system.

Soon after, he stumbled across an account of a woman who had suffered temporary brain damage. After the damage, she was very unresponsive even though she was alert. After a month she largely recovered and was able to tell her neurologist that she had been able to follow people's conversations, but she had not talked because she had nothing to say. Her mind had been "empty." Crick immediately thought "she'd lost her Will" and wanted to know where the damage had occurred in her brain. He was delighted to learn that it was in precisely the kind of area he had expected – a region known as the anterior cingulate sulcus which lies at a cross-roads between the higher sensory regions and the higher levels of the motor system. Crick went to tea and announced to some colleagues that the seat of the Will had been discovered! Perhaps one begins to see what James Watson really meant by "never seeing Crick in a modest mood!"

Looking towards the millennium, how does Crick feel about the work of his old friend and colleague, Jim Watson, now presiding over the race to sequence the human genome?

### THE QUESTION PEOPLE LIKE CRICK WANT TO ANSWER IS AT WHAT STAGE DO WE BECOME CONSCIOUS OF WHAT WE SEE? WHERE IN THE CIRCUITRY DOES THE WHOLE SYSTEM BECOME SELF-AWARE?

"My impression, speaking totally as an outsider, is that Jim did a very good job setting up the whole project. It seems to have gone better than expected. I think I would say that people don't quite realize what the impact of sequencing the human genome will be. It's going to have an enormous impact on every field of biology including developmental biology and neuroscience. As far as neuroscience is concerned, who knows what's going to happen? It's such a complicated discipline it's very difficult to say anything sensible about the future." ■



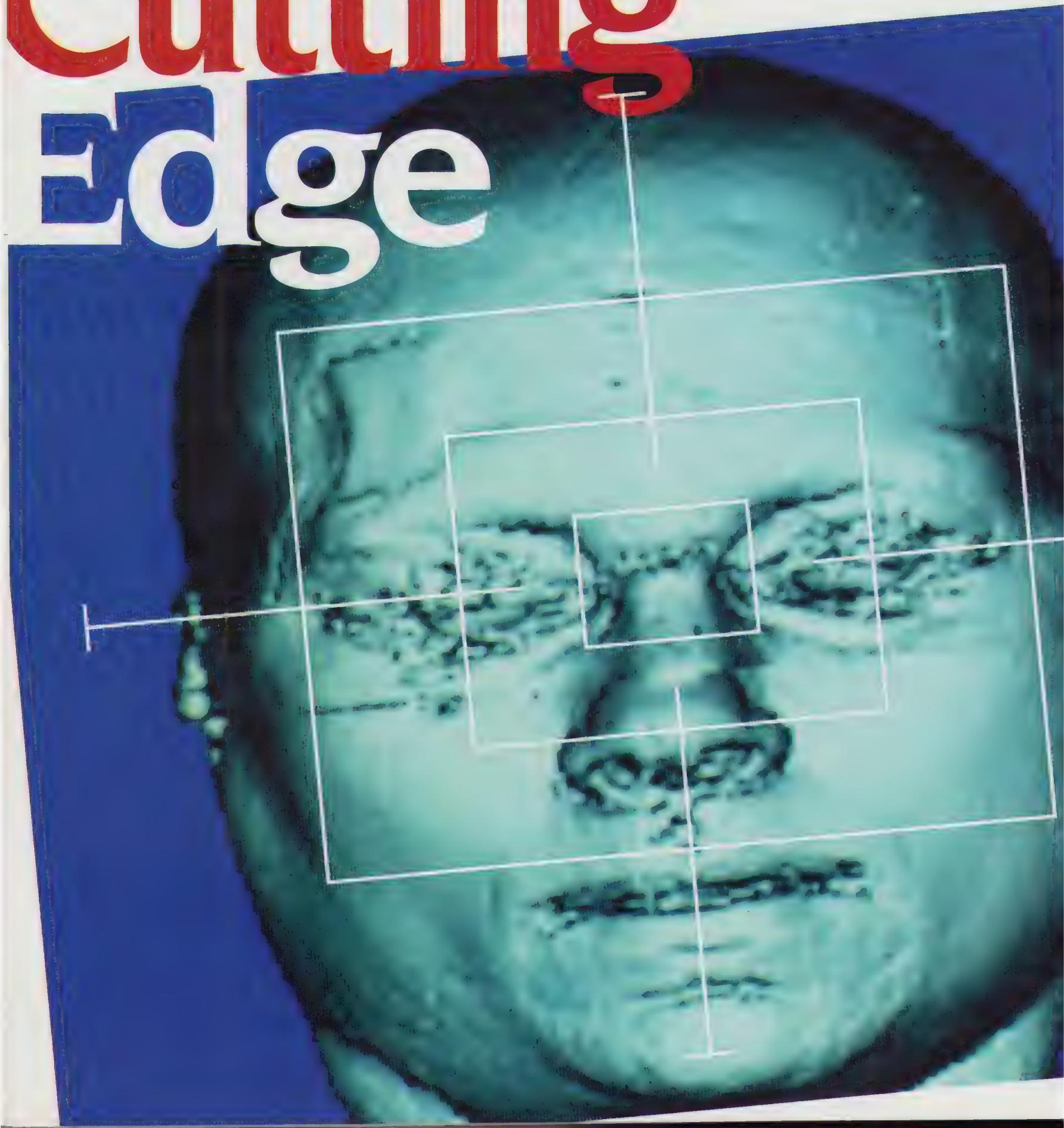
Pierre Perin

**The Replicants:** From discovering the molecular structure of DNA to grand old men of science – Crick and Watson in 1959 and 1993.



**Groundbreaking study:**  
An important operation in vision is to separate figure from ground. The classic example is the vase with two heads on either side, but a more difficult demonstration is the dalmatian which appears in this image.

# Cutting edge



by Adam L. Penenberg

THE MILITARY IS SPEARHEADING A REVOLUTION TO SAVE LIVES, USING GUIDANCE TECHNOLOGY DESIGNED TO DROP BOMBS. THE "SMART SCALPELS" OF TELESURGERY ARE COMING TO AN OPERATING THEATER NEAR YOU.

THAT LIFE IS A NUMBERS GAME HAS TAKEN ON A WHOLE NEW meaning in the field of medicine. Digital technology, the blood and guts of computers, compact discs and movie special effects, is now being used not just to imitate life, but to save lives.

The impact of this digital technology has been staggering, redefining what it means to be a physician and leading the way to fanciful surgical techniques that outstrip even the wildest science-fiction fantasies.

Research is already underway to enable a doctor in Singapore to operate on a patient in Mongolia. Creeping digitalization is helping to draft a futuristic world where surgeons enter 3-D models of their patients' inner anatomy, actually peer into hearts, livers, spleens, take brisk walks through lungs, bones and tissue, then literally put their fingers on the problem – or at least, a graphic image of the problem.

Methods are being developed that are the foundation of medicine's newest acronym, MIS – Minimally Invasive Surgery – a technique in which doctors watch a TV monitor and manipulate miniature surgical instruments through tiny incisions in the body. An appendix could be removed and the resulting scar would be less a zipper than a two-inch exclamation point.

All this is just the tip of the algorithm. One new technology enables physicians to burn away malignant tumors without touching a scalpel or rib spreader, replacing these tools of yesteryear with ultrasound waves and lasers. Breakthroughs in software and microchip technology are yielding *Fantastic Voyage*-like efforts aimed at manufacturing tiny, diagnostic vessels that could be injected into a patient, careen through veins, arteries, and capillaries, and beam back pictures to waiting physicians.

"In the past, surgeons had to rely on X-rays that were two-dimensional when the world they work in is three-dimensional," says Bill Lorensen, a graphics engineer for General Electric Corporation, who's been working with doctors at Brigham and Women's Hospital in Boston. "Today, it's possible to use a computer model as a road map for surgery. In the future, it will be possible for a doctor to walk inside a graphic representation of a patient's inner anatomy. It seems like there's no shortage of ideas, just a shortage of time to work on them all."

Telesurgery will be coming to an operating theater near you. But the theater will not only be a road show – it will be wherever the patient is. Already the nuts and bolts of these techno-tools are in place: bits, bytes and clumps of data from virtual reality systems software incorporated into life-saving medical-imaging hardware.

The reality is that virtual reality is already saving lives, although most of these technologies are still in development and not yet widely available.

"These are exciting times," says Dr Gene Barnett, director of the brain tumor center at The Cleveland Clinic in Ohio. "The way we're performing brain operations today is entirely different than it was 10 years ago, when neurosurgeons relied on metal frames and calculators to guide them through surgery.

"Now we're using a system that connects a high-speed digitizer to a supercomputer. We've developed software to go along with it that provides both localization and guidance information in real-time fashion. The results have been excellent."

**Ironically, these giant steps in medical advancement are spinoffs from military technology, systems that were designed to deliver smart bombs to targets or pinpoint laser-guided missiles.**

Barnett, who says a large number of the patients he sees have "inoperable" tumors, reports a 20 to 30 per cent reduction in hospital stays and costs. There has also been a corresponding drop in the rate of surgical complications, from 10 per cent to three per cent.

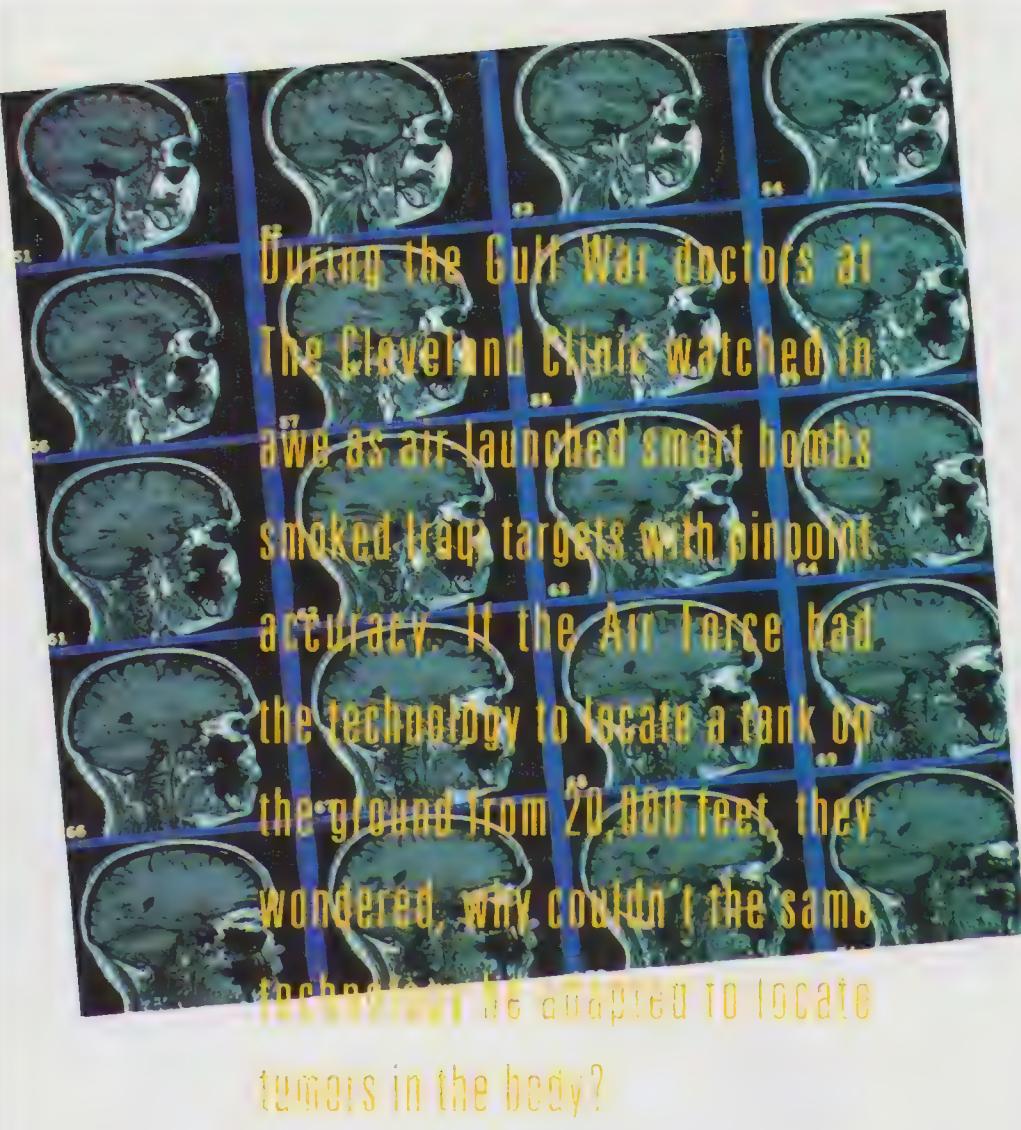
"Unfortunately there's still that three per cent who come out worse than when they went in," he says, "and this is due, in part, to a lack of resolution in the imaging. You can't see all the tiny blood vessels and nerves that come off the brain yet. Since the brain swells during surgery, unexpected bleeding leads to complications. But as the technology improves, I expect we'll see even better results."

"The big jump," he says, "will be to take this into other organ systems."

Ironically, these giant steps in medical advancement are spinoffs from military technology, systems that were designed to deliver "smart bombs" to targets or pinpoint laser-guided missiles, methods to manufacture more effective weaponry and increase the kill power of nuclear weapons and the power of defense-related supercomputers, or techniques to improve the quality of military hardware.

The fact is: technology that was designed to destroy is being modified to heal.





During the Gulf War doctors at The Cleveland Clinic watched in awe as air-launched smart bombs smoked Iraqi targets with pinpoint accuracy. If the Air Force had the technology to locate a tank on the ground from 20,000 feet, they wondered, why couldn't the same technology be adapted to locate tumors in the body?

During the Gulf War doctors at The Cleveland Clinic watched in awe as air-launched "smart bombs" smoked Iraqi targets with pinpoint accuracy. If the Air Force had the technology to locate a tank on the ground from 20,000 feet, they wondered, why couldn't the same technology be adapted to locate tumors in the body?

"There are no physical landmarks once you get inside the brain," says Barnett. "We needed better ways to see inside the skull and this required high-resolution graphics, effective target recognition, as well as the development of algorithms to monitor the brain during an operation. Many of these problems have already been solved by the military."

These solutions, in large part, rely on various approaches to television and computer graphics, whether they be telepresence, teleradiology or telesurgery – the key prefix here is 'tele,' which implies 'at a distance.' And it's not only existing military technology that's being incorporated into telemedicine's future. Each branch of the service is pumping major bucks into R & D – some estimates put the combined total at \$US90 billion over five years – and because you can't sue Uncle Sam for malpractice, the results have been very impressive.

"Since the military doesn't have to worry about liability, which is a big problem for most medical technology companies in the U.S., they can pull off what most private companies can't," says a representative of the American Telemedicine Association in Austin, Texas.

In the past, U.S. defense was predicated on the idea that war would require either massive troop movements or nuclear annihilation. Now, the U.S. military has been reshaping its mission in order to maintain battlefield readiness in a confusing new world order, a world where arch-enemies of the past are the allies of today, and where brushfire conflicts break out seemingly on a daily basis. The emphasis is on a highly mobile military with the capability to strike quickly and get out quickly, because you never know where the next war's going to be. As a result, each branch of the service has invested, to varying degrees, in bringing telepresence into the theater of war, and sharing this wealth of knowledge with hospitals.

Earlier this year, the Navy reports, a telemedicine hook-up between San Diego and Zagreb saved the leg of an Egyptian peacekeeping soldier who'd been hit by mortar fire. Using a telemedicine hook-up, doctors in Zagreb were walked through an extremely complicated bone-lengthening procedure. Although originally the doctors on site expected to amputate the limb, the operation was a success, and the patient is expected to recover the full use of his leg. The Navy plans to install telemedicine hook-ups on all its ships, at all its bases, "and probably in isolated areas in the civilian community," as well.

Wright Patterson Air Force Base has been working with doctors at The Cleveland Clinic on ways to locate and operate on brain tumors. The Air Force estimates that by using advanced medical technology to treat the most frequent forms of cancer, the nation will save \$US10 billion annually in medical costs. Meanwhile, the Army's Advanced Research Projects Agency (ARPA) has been experimenting with ways to revolutionize battlefield casualty care. Led by Dr Richard Satava, an army colonel many consider to be one of the leading authorities on telemedicine, ARPA is developing state-of-the-art technology designed to decrease combat mortality.

"In spite of advanced evacuation capabilities, the mortality rate for wounded soldiers has remained at 90 per cent over the centuries," writes Satava in a paper titled "The Modern Medical Battlefield." Modern technology may make it possible to reduce mortality at the front lines... by placing emphasis on sending the surgeon back to the front lines in real time – but with telepresence."

At General Electric, a gargantuan corporation with both medical and military-hardware divisions, the emphasis has been on image-guided surgery using 3-D graphics to detail the inner anatomy of a patient before, during, and after an operation. Bill Lorensen and co-worker Harvey Cline concocted the idea while working on a technique to inspect airplane parts.

"We came up with a pretty clever algorithm, a recipe for the computer to follow in order to accomplish a specific task," says Lorensen. "Our idea was to take a stack of 2-D images and extract a surface of the skin and skull. Others had done this before, but their approaches were cumbersome, and they had a hard time working with real data."

# By manipulating the computer image with the "real" image, the doctor can see "inside" the patient via the computer-derived image while simultaneously performing the surgery.

In 1984, when they began their work, computers were significantly slower than they are today. But Lorensen and Cline could see the possibilities, and began attacking the problem under the assumption that computer technology would inevitably catch up.

About a year ago, the two began taking the technology a step further. Instead of having the surgeon take pictures of the patient into the operating room for reference, Lorensen, Cline and their collaborators at Brigham and Women's Hospital decided to set up a work station in the operating room and create the 3-D models on the spot, point a video camera at the patient, then combine the two images.

By manipulating the computer image with the "real" image, the doctor can see "inside" the patient via the computer-derived image while simultaneously performing the surgery.

"It's meant as a guide, like a road atlas. It doesn't tell you to the millimeter what you need to know, but it does give a good overall view," Lorensen says. "The doctor looks at a TV monitor that has the combined image and can see the scalpel in his hand. At the start of the operation, the doctor can trace an outline of the entry point, see the tumor in the combined image, then trace an outline that will direct him to the tumor."

For now, the job of aligning the two images is performed manually, but researchers at Brigham and Women's Hospital, Massachusetts Institute of Technology and TASC, a defense contractor, are working on a technique that would automatically superimpose one picture over the other.

"We do it by eye now," Lorensen says, "but soon it will be done by computer. We call it 'enhanced reality' because we're taking real images and enhancing them with computer images."

According to Dr Ron Kikinis, director of the surgical planning laboratory at Brigham and Women's Hospital, as surgery moves toward minimally invasive surgical techniques in the coming years, technologies relying on 3-D graphic imaging will become more pervasive.

"MIS techniques have numerous advantages over the type of surgery performed today," says Kikinis, a radiologist who has worked with Lorensen and Cline for six-and-a-half-years. "Unfortunately, the disadvantage is that the surgeon's view is limited. But this technology helps us to see inside a whole lot better."

Available at some U.S. hospitals, MIS reduces recuperative time, postoperative scarring, and most importantly, pain, since less tissue and muscle is bruised during surgery, Kikinis says. It's also significantly cheaper. General Electric is also working on other impressive technologies, like a magnetic resonance therapy system (MRT) in which the doctor steps into a magnetic field and can see an image of the patient's internal anatomy throughout the operation, acquiring images that are constantly updated. These updated images are the key to improving today's surgical techniques, since, after a sizeable incision, a body can change markedly as organs swell, leading to complications during and after surgery.

The future is leading toward surgeons donning 3-D virtual reality goggles and walking through graphic image representations of their patients' inner anatomy, waving an "electronic scalpel" at health problems that were once unseeable, and mending what was once unmendable. But the technology that fills one of medicine's greatest needs involves the use of ultrasound waves and lasers. "Focused Ultrasound" is surgery without cutting, scarring, or pain. If, say, a patient is found to have a tumor, the doctor can outline it on the computer screen and direct focused ultrasound beams on it.

"The doctor can even practice first by firing tracer rounds," Lorensen says. "Once you're sure of the location, you fire away and cook the tumor. Of all the telesurgery technologies they talk about this is most imminent because it already exists and it takes place at a distance because the doctor is in the next room."

As all this new technology is thrown into a worldwide database, the pace of scientific discovery could speed up dramatically as we tumble into the year 2000. But although medicine's tools may change – have changed markedly over the years – one thing hasn't, nor will it.

Says Barnett: "One thing people have to remember about these tools is that they are just that, tools. They assist surgeons, they don't replace them. They won't make a bad surgeon a good surgeon, but they will make a good surgeon that much more effective."

"Because nothing can replace good surgical judgement."

At least, not yet. ■

**General Hospital:** General Electric's developments with 3-D imaging have enabled surgeons to conduct minimally invasive surgery on patients. This reduces post-operative scarring and most importantly pain, since less tissue and muscle are bruised during surgery.



Bill Lorensen

**Tracer Scalpels:** Using a TV monitor showing computer-derived images of the brain, the surgeon can trace an outline of the entry point, see the tumor in the combined image then trace an outline that will guide the doctor into the tumor.



# HP=MC<sup>2</sup>

The key to success in the IT industry is execution. And execution requires energy and a commitment to getting high-quality products onto the market at the right time, right price and with the right features.

It sounds too easy, really. In fact, Hewlett-Packard has reduced the strategy to a simple formula. It's HP=MC<sup>2</sup>. Believe us, a formula like this could explode a few myths and change the world.

The 'MC<sup>2</sup>' stands for Measurement, Computers and Communications. These, we believe, are HP's strengths now and into the 21st century.

In a business environment where most rivals share similar technologies, nobody gets light years ahead of the competition. Success is hard-won and long remembered. Hewlett-Packard made the first desktop scientific calculator. That was eons ago – in 1968. The company was a pioneer in the days when PC might have stood for 'pocket calculator'. HP made the first pocket calculator in 1972.

Today, HP ranks first in minicomputers and laser printers, second in workstations, and first in a range of scientific measurement and medical instruments. Personal computers are the company's fastest-growing activity. In 1993, sales of HP products rose by almost a quarter to \$US20.3 billion. That's a lot of success and a lot of execution.

In the future, the company will be applying its MC<sup>2</sup> strategy to a new objective: merging its skills and experience into technologies to serve a multimedia age.

This is already happening. Earlier this year, Hewlett-Packard won a contract to supply computers for an interactive television system in the United States. The computers will store the movies and catalogues ordered by the system's subscribers.

Doctors in California are currently testing HP's prototype of a 'physician's workstation' – an MC<sup>2</sup> device if there ever was. The workstation collects medical data from a network of hospital computers that variously contain information such as patient histories and pathology results, and assembles them for assessment on one computer screen.

The company is also working on software systems to make computers easy to use and program.

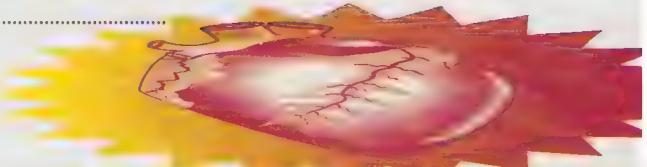
Further afield, HP hopes to produce a hand-held computer that also operates as a mobile phone, fax machine and electronic mail box. The machine will provide a wireless link to a computerised database or the printer at your office.

Few other companies have the established skills and experience to produce such multimedia devices. As the worlds of measurement, computers and communications come together, Hewlett-Packard hopes to make a unique contribution to IT that the others will find hard to beat.



# scan

*medicine: animal organs  
replace human parts*



*design: creating the first  
interactive office – outside work*



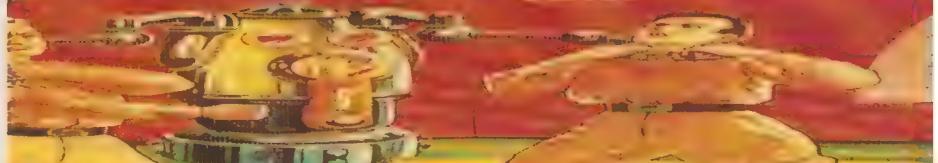
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# the beast within

BY JULIE A EGAN

**B**aby Fae was born with a death sentence; a defective left ventricle. When she was 15 days old, on October 26, 1984, Dr Leonard L Bailey of the Loma Linda Medical Center in California, transplanted the heart of a baboon into her body. Baby Fae died within 21 days. Critics said that an adequate search for a matching human heart hadn't been made and that medical research, rather than concern for the individual, was the main motive behind the intervention.

The controversy continues. While kidney patients can wait years for a suitable match and those needing new hearts, lungs or livers may never even make it off the waiting list, dying before organs are available, the quest for xenotransplants (transplants from non-human donors) has received renewed attention. Transplants make economic sense – patients on waiting lists eat away at the dwindling health dollar.

Transplanting animal organs is not new. The first successful kidney transplant was carried out between identical twins in Boston in 1954. As early as 1906, however, Professor Mathieu Jaboulay of Lyons attempted to transplant goat and pig kidneys into humans with as much success as Daedalus' attempt to attach wings to his son Icarus.

The 1920s saw the wide-spread practice of testis transplants from monkeys and goats to rejuvenate male patients. Many believed that the testis controlled not only sexual vigor but aging. "You are only as old as your glands," claimed 'Dr' John Brinkley from Kansas, whose goat-gland operation was to make him a millionaire by 1930. By the end of 1926, French surgeon Serge Voronoff, who pioneered the testis transplant, had carried out over 1000 operations using testes from chimpanzees and, later, baboons.

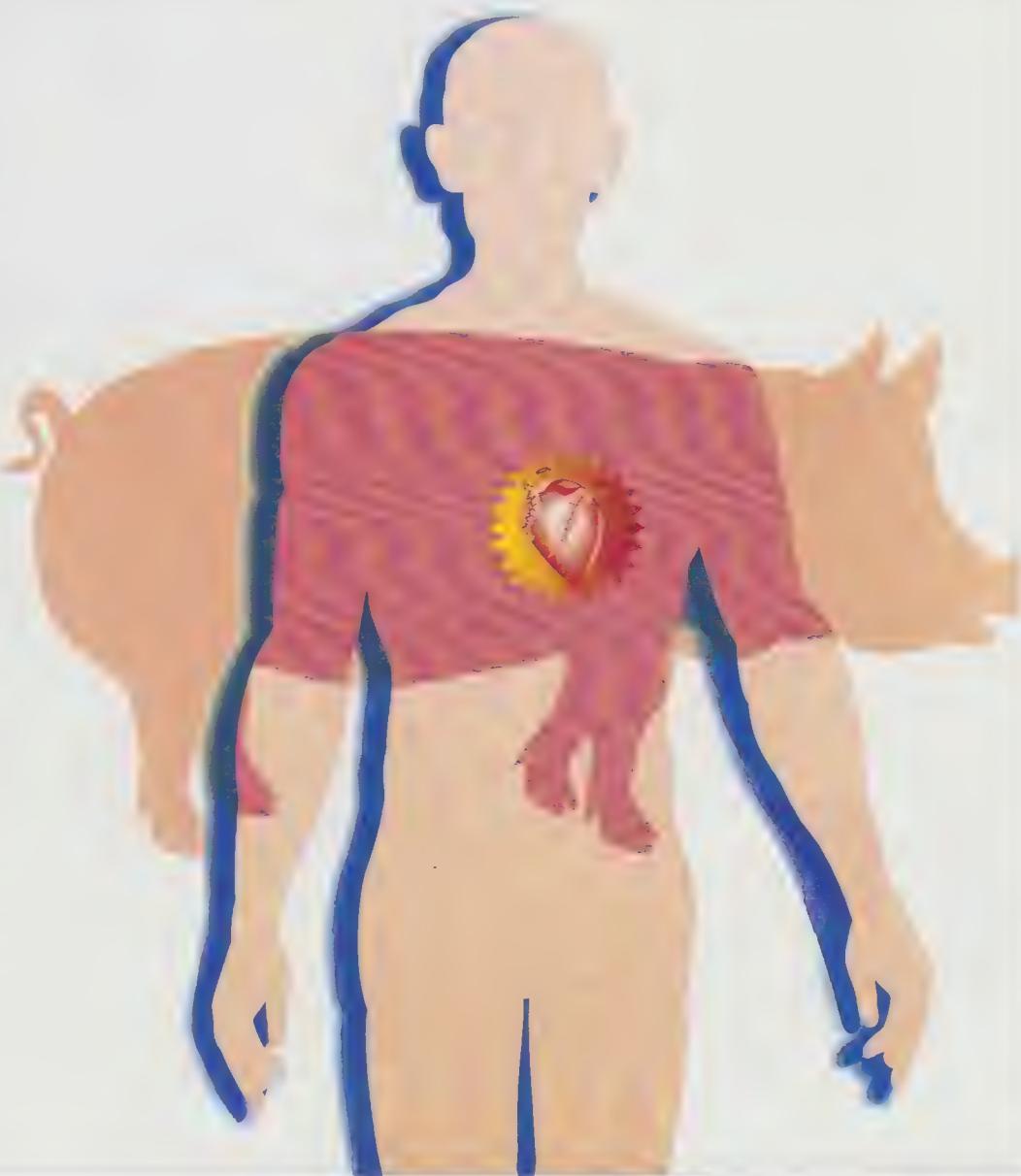
With a greater understanding of immunology, monkey-gland transplants fell into disrepute and it was not until after human-to-human transplants became routine, that surgeons once again turned to animals.

Animal-to-human transplants have a dismal track record. The immune system that protects the human body against invasion by foreign materials such as bacteria or viruses also attacks foreign transplanted tissue. The immune system recognizes foreign cells by the presence of molecules called antigens on their

surfaces. The antigens that provoke graft rejection are found on all cells in the body except the red blood cells. These antigens can be easily identified on the surface of white blood cells and are known as HLA (Human Leucocyte-associated Antigens).

For a graft to be successful, the HLA must match closely. There is no graft rejection between identical twins as they have the same antigens. The less correspondence between the tissue antigens of the donor and the recipient, the more intensive and rapid the rejection.

The most important cells in the immune system are the specialized white cells, the T and B lymphocytes. T-cells bind to the antigens on the foreign cells and destroy them. B-cells make antibodies, proteins that circulate and initiate reactions that can destroy the foreign cells. Rejection is usually mediated by T-cells which infiltrate and destroy the graft over a period of days to months. This rejection can be controlled by treating the recipient with drugs like cyclosporine to suppress the immune system, as was first done during a kidney transplant between non-identical twins in 1959.



Norm Robinson

**"If you are prepared to eat it,  
you should be prepared to use it  
to save someone's life."**

The problem of rejection is more serious with xenotransplants. As well as T-cell activity, xenografts (organs from other species) elicit what Dr Mauro Sandrin, from the Austin Research Institute in Melbourne, calls the "really violent" phenomenon of hyperacute rejection. While T-cell mediated rejection occurs over weeks to months, hyperacute rejection, which depends on the presence of antibody to the transplant in the recipient, occurs within minutes, reducing the graft to a mass of clotted tissue.

This phenomenon also occurred in the early days of human donor transplants, but careful cross-matching means that it is now rare. The problem with xenotransplants is that all humans have naturally occurring antibodies in their blood to tissues from almost all other mammals. As soon as the recipient's blood flows into the newly connected organ, antibodies bind to antigens on the cells lining its blood vessels and set off what is known as the complement reaction, a sequence of reactions involving proteins in the blood which eventually results in destruction of the graft.

Sandrin and his colleagues have identified the most important animal antigen that reacts with the human antibodies as a particular group of galactose molecules on the cell surface.

"The idea is to insert one or two human molecules into the pig so rejection will be delayed or more easily controlled by modifying the complement reaction," says Dr Tom Mandel, head of the transplant unit of the Walter and Eliza Hall Institute in Melbourne.

The complement reaction does not run amok in our own bodies because of the existence of complement regulators on the cell surface. Organs from animals into which genes for human complement regulators had been inserted would be more resistant to hyperacute rejection. In 1992, Astrid, the first transgenic pig, was born. Three transgenic pig lines with human complement regulators have now been established.

Another approach is to knock out the gene coding for the enzyme synthesizing the sugar antigen on the animal cells so that there is nothing for the antibody to bind to. Researchers at the Austin Research Institute

have cloned the gene for this enzyme in both pigs and mice and are working to make it inactive.

Pigs have many physiological similarities to humans and have been widely used as a source of insulin, skin and heart valves. Tom Mandel's particular interest is in the use of pancreatic islet transplants (the islets of Langerhans are the groups of specialized cells scattered throughout the pancreas which produce insulin) as a possible cure for diabetes. What regulates insulin secretion in the pig is almost identical to what regulates insulin secretion in the human.

In contrast to pigs, which are readily available, many primates (which, on the surface, appear the more obvious choice as organ donors) are on the endangered species list. Add this to the problem that primates can be a source of viral infections potentially lethal to humans. A primate liver could also be infected by a human virus, a major consideration given that many liver transplants follow destruction of the liver by viral hepatitis.

The Baby Fae case generated a storm of controversy but even those who totally oppose the use of animals for organ transplants, like animal rights advocate Professor Peter Singer, deputy director of the Centre of Human Bioethics, Monash University, Melbourne, do not necessarily see xenotransplants as a major issue – not when "there are people who are killing pigs because they like the taste of bacon at breakfast rather than fried onions." As the Austin's Mauro Sandrin counters, "If you are prepared to eat it, you should be prepared to use it to save someone's life."

In order to develop a society with a better attitude to animals, xenotransplants should be discouraged, says Singer, who sees animal organs as a temporary stop-gap towards development of synthetic organs. The ready availability of animals draws attention away from trying to improve the supply of human organs, animal rights advocates believe.

If genetic material is what determines identity, the creation of transgenic animals raises serious questions about confusing the status of beings says ethicist Nicholas Tonti-Filippini. At what point does the replacement of a human's organs affect their individuality?

Tonti-Filippini sees potential dangers in the use of desperately ill patients in what is largely an experimental program. While clinical medicine is unequivocally in the patient's best interest, the motives of medical research are not so clear.

There is a fear that commercial pressures will encourage premature experimentation. Competition between the companies responsible for the development of transgenic pig lines, Imutran in the United Kingdom and DNX Corporation and Alexion Pharmaceuticals in the United States, is likely to be encouraged by the failure of patent law to adequately address the issues of transgenic animals.

Imminent death sheds a particularly bright light on ethical issues. How do potential recipients of animal organs feel? The Austin Hospital recently surveyed all those on the waiting list for a kidney transplant in Victoria. Asked whether they would accept a pig kidney tomorrow, only 10 per cent refused on moral, religious or ethical grounds. Of the remaining 90 per cent, 40 per cent wanted more information and 50 per cent agreed immediately.

Xenotransplants will provide both permanent and temporary solutions, prolonging life until a suitable human donor becomes available.

Virtually all children born with a poorly formed heart die because of the lack of a donor heart – a xenotransplant would be a bridging operation. Pancreatic islet transplants are, on the other hand, likely to be permanent.

"The wild card is that there are probably half a dozen immunosuppressants in the pipeline, some of which could be very much more effective in controlling rejections than those used today – if that's the case everything would be accelerated remarkably," says Mandel.

The fathers of modern transplantation, immunologists Peter Medawar and MacFarlane Burnet, originally dismissed human-to-human transplants as impossible: science fiction. But, today, the creation and maintenance of a porcine doppelganger, a genetic twin constructed years in advance of any anticipated medical problem, may be a particularly healthy investment. ■

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## @work

BY ANDREA MOED

**M**ultimedia designer Jeet Singh is driven by the dream of a work/game/online/real world/all-purpose/no-purpose electronic community. Since 1991, when he and fellow MIT Media Lab graduate Joseph Chung founded the Art Technology Group he has constantly redefined and expanded his dream. Their new-media design firm specializes in bringing human interaction online. Projects have included an

With its fixed territory and orientation for each employee, it was unsuitable to the project- and team-based work done by his agency, and it was on the way out. As he later explained, "All our lives we know where we're going to sit. Now we're saying you don't know where you're going to sit. What you need to know is what you're going to do."

The agency's new office in lower Manhattan reflects Chiat's new order, with a reduced floorplan and personal space factored out of the equation. Designed by trendy European architect Gaetano Pesce, the office's open, colorful interiors excite the eye but lack any corners to settle into. The furniture is modular, the project rooms temporary, the employees given, literally, a place to hang

**"All our lives we know where  
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electronic-imaging exhibit for Chicago's Museum of Science and Industry, a multimedia movie kiosk for Sony, and technologies for numerous public spaces and performances; most have been connected in some way to the pursuit of Singh's ultimate networked community, referred to around the company as Red Star.

Their dream of a networked community coincides with a trend in business that is highly conducive to the restructuring of the office. With downsizing trends of the past few years, corporate employers have been shrinking their real estate holdings, not just encouraging telecommuting but making it less viable to work at the office and more desirable to be a solitary itinerant, following the job from place to place in the course of a flexible and expanded business day. In the interests of efficiency and reduced overhead, these companies are routinely handing their employees laptops and cell phones, and urging them toward the door.

No firm has pursued this agenda more publicly than the advertising agency Chiat/Day. As their PR tells it, in the spring of 1993 the agency's CEO, Jay Chiat, came down from the mountain (in Telluride, Colorado, where he was skiing at the time) and proclaimed the obsolescence of the traditional office.

their hats and no allowance for clutter. It is an intentionally uncozy place, meant to keep its occupants moving.

With the hardware of the virtual office in place, Chiat/Day hired ATG to graft on a software comfort zone – an audiovisual interface that could be pumped out over the phone lines to provide any Chiat/Day employee, anywhere, with the supportive work environment they wanted... in two dimensions. ATG's solution is now a groupware product being marketed with Chiat/Day to other companies. Its codename is Oxygen.

What does it mean to have a sense of place? While ATG approached this question from a Net-savvy point of view, Chiat/Day's employees were territorially nostalgic. During ATG's R&D phase Chiat/Day employees expressed the need to feel "in the loop"; to know intuitively what they had to do first every morning; to publicly display pictures of their pets and kids – all of which was now denied them in the physical world. From Singh's perspective, both he and Chiat/Day's anxious new telecommuters were worrying about the same things: how could you convincingly express "presence and personality" on the Net?

To begin the demo, Oxygen project manager Michael Fleshman logs into Chiat/Day World and types in his password. If he were a real Chiat/Day employee, he'd be at work now. Against a background of his choosing (this is where you can put the pictures of your kids, he notes) float his personal effects: icons representing files, documents, graphics, applications, little yellow notes that look like they were slapped on the wall. Some of the icons are new and neat, others seem to crumble with age. A message center tells him if he has voice- or e-mail, and a calendar displays the coming week. This collage is known in Oxygen as a personal room, the formal stand-in for each person's office. With a cartoonish "pop" sound, a digitized picture of Mike appears in the office. He and his computer could be at home, in a client's office, or anywhere, but to anyone else logged into Chiat/Day World, he is now 'here' in this 'room.' His picture is smiling, but if he chooses, it can frown or turn its back.

Clicking on a 'world map' on his 'wall,' Mike shows us all the other places he can go – other people's offices; project rooms where collaborative work is created and stored; or the café, a communal social room. "Subway lines" named for accounts and departments run through the map like toy trains through a model town. Everything on the map is accessible; if Mike wanted, he could go right into the boss' office and stick a Post-it note on his face. Instead, he decides to get a co-worker's attention. Selecting the co-worker's name from a "people-finder" display, he clicks on a button. On his "co-worker's" computer (which could be at the next table or across an ocean) a synthesized voice says, "Yo!" Having heard the message, the colleague "pops in" for a visit; they "chat" by typing at each other. As they type, the conversation appears in word balloons that protrude from their heads, comic-strip style. Of course, they can just as easily talk on the phone, causing pictures of telephones to appear beside their faces on the screen.

In its organization of information into spaces, objects, and people, Oxygen is based on the same logic as MUDs (Multi-User Dimensions), interactive sites on the Internet where thousands of users converse and explore. MUDs are composed solely of

# 21•C Back Issues

textual descriptions written by their creators, plus the collective visualization of their players. Oxygen upgrades the fantasy by presenting pictures of its imaginary worlds, leaving less to the imagination. The graphics also enable the exchange of what Singh calls "serendipitous information" – sensory input gathered by chance and taken for granted in the real world. The novelty of Oxygen is in seeing the expression on a friend's digital face, or the simulated decrepitude of your old files. But for all its visual richness, Oxygen is no immersive VR experience. It doesn't try to simulate reality, it merely symbolizes it through broad visual cues. Unlike Nintendo or life, it doesn't demand a response to every event; you can tune in and out of it. In that way, it replicates the underlying message of Chiat/Day's physical office: no more overt supervision, no public eye to enforce workplace behavior. If there is supervision in Chiat/Day World, it is covert. Somewhere on a database is the electronic trail you leave in the system; your avatar is eminently watchable. Does this situation amount to accountability or surveillance? It all depends on who is following the trail.

This issue will become increasingly important as ATG adapts Oxygen for use by other clients, linking new virtual worlds to Chiat/Day's and its own. ATG's next plan is to move Oxygen beyond the corporate realm, as an online service. An Internet version already exists. If there is an ultimate goal to Oxygen, it seems to be to make the spatial conception of electronic community accessible to more and more people. This would allow them to dream, as Singh does, of work, play, commerce and other communal aspects of their lives all connectable by a stroll around the virtual block. This merging of spheres is the essence of Red Star. When asked if its effect will be to isolate people behind their screens, or to make already isolated people relate better, he replies, "I like to think the latter," but admits he doesn't know. "Things will happen in that environment," he predicts, without ever saying what. ■

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**No. 11: Greening the Blue Planet.** Sustainable development special report; Hormone replacement therapy; Neutrinos; Global warming's economic impact; Superchips.

**No. 12: The Electronic Dream.** Alvin Toffler on information monopolies; The new pornography; Information technology special report; Bill Gates; Paul Davies; Cancer research; The birth of the universe.

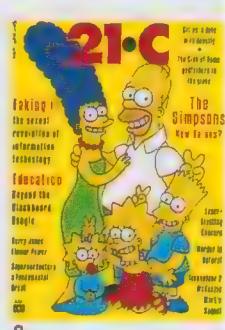
**Volume 2 No.1: Outlaws on the Net.** William Gibson interviews U2; Jungle Fever: viral plagues from the forest; Romancing the Stone Age: from Jurassic Park to the Ice Man; Al Gore's vision of the Net; David Lange on the UN's impotence; Designer Drugs



4



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TO ORDER, FILL OUT THE COUPON IN THIS ISSUE.

IF THE WAR IN CAMBODIA WAS A MEDIA "SIDESHOW," THE COVERAGE OF WAR-RAVAGED FORMER YUGOSLAVIA REFLECTS THE MAYHEM AND POLITICAL MACHINATIONS OF RACIAL INTOLERANCE IN AN UNCIVIL WAR. FILMMAKER LESLIE GLADSDJO'S DOCUMENTARY *TRUTH UNDER SIEGE*, IMPLICATES MAINSTREAM MEDIA FOR CIRCUMVENTING THE STRUGGLE FOR A DEMOCRATIC, MULTICULTURAL STATE.

# true lies

BY ADAM LUCAS

**W**hen media bombardment familiarizes terror and war, war begins to appear "natural." It "just happens." And countries simply become "trouble spots."

San Francisco-based filmmaker Leslie Gladsjo recently completed shooting the documentary *Truth Under Siege: Dissident Media in the Wars of the Yugoslav Succession*, with her Belgian partner Nathalie Borgers. Funded and already broadcast by European and Canadian cable TV networks, the documentary presents the views of journalists working for independent media in Sarajevo, Zagreb, Belgrade and Split (Croatia). The project was completed over a period of six months on a budget of \$US200,000.

Like her earlier work with U.S. machine-performance group Survival Research Laboratories, and performance artists Kathy Acker and Karen Finley, Gladsjo's latest documentary has no narration. Gladsjo points out that she and Borgers wanted the people they interviewed to represent what was happening in

their own words, "rather than a bunch of Westerners giving their opinions." "After all," she explains, "they are the ones who really have to decide about the future of the republics, not the U.N. or the E.C."

Another motivation for making the documentary was to present a view of the war which is outside the narrow framework imposed by the mainstream media. "In the U.S. you only get one picture of what the war is like, and it's very simplistic. It's usually presented like sport – there's a good team that you root for and all the others that you hope they beat. Of course it's a lot more complicated. There are many people in each of the major cities of the former Yugoslavia who are against the war because they are against nationalism and ethnic division."

*Truth Under Siege* opens with a series of images of tanks and troop carriers rolling through ravaged streets, buildings burning, civilians fleeing, corpses being piled up and laid out in rows. A voice-over by

Veran Matic, director of Belgrade Radio B-92, declares that "The first 'assault stations' who started this war were the State television stations in each center of the former Yugoslavia."

Milos Vasic, journalist for the independent Serbian weekly *Vreme*, reiterates Matic's observation. He says that Croatian and Serbian nationalist forces created an atmosphere of fear and hatred at least five years before the war started. He feels that his fellow journalists have a lot to answer for. "Propaganda started this war. Without a minimum of professional and human decency among journalists, it would have been extremely hard to have a war like this."

The setting cuts to the streets of Belgrade. A young, well-dressed woman looks directly at the camera, her face expresses a mixture of resignation and wry cynicism: "The media are to blame for everything that's going on here." Another woman says angrily, "They're lying, everybody is lying."

Far from the troubles in the former Yugoslavian republics, Gladsjo calmly lights up a cigarette in her temporary lodgings at the College of Fine Art in inner-city Sydney. She explains that, following the division of the Yugoslav State-run media into three separate blocs controlled by each of the new republics, nationalist politicians in both Serbia and Croatia immediately seized the opportunity to exploit their media as propaganda tools, whipping up ethnic hatred in the years leading up to the outbreak of war. Because most of the population's access to news was through State-run media, the public soon didn't know what to believe. "It's not that they are hysterical nationalists who are just obsessed by some bad history, it's that they really have been manipulated. There's been a power-play using the State TVs which has influenced people into thinking that they have something to fear."

The Croatian and Serbian journalists who remained skeptical of their new leaders' claims could see the direction that things were going, but were powerless to stop them, as the governments in each of the republics have virtually total control over what is broadcast, and there remain few independent information outlets.



**Nationalist Lampoon:** Enemies of the free press before and after the creation of the Yugoslav republics, Yugoslavian communist leader Slobodan Milošević and Croatian Nationalist Party leader Franjo Tuđman were lampooned in the satirical weekly *Feral Press* with this front page manipulated image.

**Spreading the word:**  
**Vesna Roller** (right above), a Croatian  
freelance journalist interrogates a  
U.N. official while (below) in Belgrade  
the independent Serbian weekly,  
*Vreme* is sold.



care for normal life in Bosnia-Herzegovina. It's a crime to reduce the situation in the way they have."

When asked what she hopes to achieve by making the documentary, Gladšo is philosophical, "We see it as one way of presenting another view of the war. It's also a way of showing the difficulties of having a free press, both in a situation where you're coming out of communism and supposedly going towards a more democratic situation, and also what are the personal responsibilities for journalists working under that kind of political pressure. It seems that most people will just go along with it, but there's a few who don't. We were curious about why those people don't accept what they're told, and in getting their perspectives on the war."

"Being racially mixed myself, and having grown up in an area where there is a lot of racial mixing, I know that that kind of situation can easily switch into racial tension and even open conflict like you saw in the L.A. riots."

"Nathalie is a French-speaking Belgian living in Brussels, where there is similar ethnic tension. So we were both interested in the ways in which ethnic intolerance can be fuelled and manipulated. It is now the case that the war is based on ethnic and nationalistic rivalries, and there's a lot of fear and misunderstanding on all sides, because a lot of bad stuff has happened, which makes it even easier now to keep it going. Unfortunately, because of that, I don't see a real solution. I think the easy solutions, if there were any, would have come a few years ago. Right now, it's very difficult to resolve." ■

Unsurprisingly, the directors of the State-run television stations in each of the republics claim that their own reportage is more accurate than the other's. At the beginning of the documentary, the head of Bosnian television even puts a figure on it: "At least 75 per cent of what we report is the truth." Milorad Vučelić, director of Serbian television, claims that it's absurd to say that propaganda has been promoting the war. He says that the "great powers" provoked the war because they wanted to destroy "this country," although he doesn't explain which country he means.

Serbian Information Minister, Slobodan Ignjatović, says that the Serbian media avoided showing the atrocities committed by Croats and Muslims "until they had no choice." Veran Matic from Radio B-92 directly contradicts this assertion. He says that from the very first days of the war, details of atrocities were broadcast by the Serbian media; "the victims were always said to be Serbs."

Petar Luković, deputy chief editor of *Vreme*, the independent Serbian weekly, is in no doubt that Serbian TV is lying on a massive scale. His co-editor, Milos Vasic, is similarly skeptical, "It's a bit odd that every shot which kills less than 10 people is from the Serbs, but every shell which kills more than 10 people or five children is being fired by the Muslims. Something stinks in the whole story." With a look of obvious distress, he explains that, "When people are subjected to so many lies, they begin to crack. Poor, hungry, and intimidated people don't go for dramatic political change in the street or in the elections."

On March 9, 1991, an enormous democracy demonstration of over 100,000 people was mounted in Zagreb. The demonstration was crushed by the Yugoslav communist regime headed by Slobodan Milošević, with two protesters killed and independent media temporarily shut down. Veran Matic from Radio B-92 says that Milošević then began a purge against dissenters, including independent journalists. But despite Milošević's attempts to suppress dissent, dissident media continued to actively oppose his authoritarian rule.

The situation did not improve with the creation of the new republics, however. Vesna Roller, Croatian

freelance journalist, claims that when AIZ (the Croatian Nationalist Party, led by Franjo Tuđman) won the elections, both the government and the media moved, from a fairly tolerant post-communist attitude, to post-World War 2 authoritarianism.

While many Croatians support their nationalist government, many do not. The satirical weekly, *Feral Tribune*, is regarded as unpatriotic and seditious by Croatian nationalists. But a lot of them still bought the issue with Tuđman and Milošević in bed together on the cover, as *Tribune* workers attest. Viktor Ivanić, the magazine's chief editor, explains the *Tribune*'s rationale: "We refuse to be swept away by hysteria over the so-called great historical moments which would demand that we become consciously stupid, especially when that stupidity could cost us our heads." He then details how he was drafted into the Croatian Army for 12 months.

The government in Bosnia-Herzegovina was reputedly non-partisan in its initial handling of the media, but as the war dragged on and pressure built up from within the republic for a Muslim nationalist state, the Bosnian media has bowed to that pressure. Although Gladšo and Borgers had planned their documentary to feature a journalist from the award-winning Bosnian daily newspaper, *Oslobodjenje*, they were told by locals that the paper had lost its autonomy and was now pushing a pro-Muslim line.

"They were printing articles against mixed marriages and listing the names of people who they said had been in the JNA (Yugoslav National Army)," Gladšo explains.

Consequently, rather than featuring a co-opted mainstream-newspaper journalist in Sarajevo, the filmmakers chose to feature dissident journalists working in print and radio. Adil Kulenović, director of Radio 99 in Sarajevo, is also a poet and prominent intellectual. He has no doubts about the move towards Muslim nationalism on the part of the Bosnian government, "Even the most prestigious TV companies and journalists over-simplified events to make a story about three warring sides. They never wanted to acknowledge the fourth side, to which the largest number of people belong, those who really



# whole-earth ballard virus

## The Millennium Whole Earth Catalog: Access to Tools and Ideas for the Twenty-First Century

EDITED BY HOWARD RHEINGOLD  
POINT FOUNDATION  
REVIEWED BY ABBE ARONSON

**L**aunched in San Francisco in the late '60s for \$1 a copy, *The Whole Earth Catalog* introduced readers to natural foods, recycling and alternative childbirth. Today, the catalog is reintroduced as *The Millennium Whole Earth Catalog: Access to Tools and Ideas for the Twenty-First Century*. With this US\$50, 384-page hardback edition, the editors hope to catch a new generation of readers who grew up recycling because it's law, not just a way to raise one's consciousness.

The catalog is broken into 14 categories, ranging from Biodiversity to Political Tools, but all with the same eco-friendly bent as the original issue. Each category includes book reviews with text or photo excerpts, quotes from related literature – both historical and nonsensical – and out-of-the-way craft or hobby ideas. Addresses and telephone numbers are provided so that the reader can contact sources for more information.

Like any catalog, the MWEC is a tease, filled with enough snippets to snag the reader's attention without spoiling the plot. To capture a new and younger audience, a five page introduction to the Internet is offered under the Communications category. The guide features common language – "The Internet is more like a jungle than a freeway: nobody planned it, it just grew" – and offers opinions on which books are bibles and which are baubles.

Likewise, a two-page "how to" guide for launching a fanzine is included, written by Jerod Pore, editor of "the 'zine of 'zines," *Factsheet Five*. Pore instructs: "Those of you blessed with a McTemp job probably have access to computers, printers, photocopiers.... Go to lunch at 11.30; return at 12.15; take advantage of the lightly populated office to learn PageMaker. I got started in self-publishing with a typewriter retrieved from one dumpster and paper retrieved from another."



Frank's Seal Pic: Jim Woodring from Millennium Whole Earth Catalog

Also added to the catalog to wow the youngsters are page margin "flip morphs." A speedy reader can watch as the black and white photo of the Earth is transformed into a bouquet of flowers, then into the new *Millennium* logo.

Despite all the proclamations that it's a new catalog poised for the year 2000, many of the catalog's illustrations are throwbacks to the original. The photography for "Spiritual Midwifery" (under Health) is straight out of the '60s commune. Ditto the photos for "Outdoor Sounds" (Whole Systems), which present readers with a guide for capturing noises in nature. The text may suggest digital audio tapes but the article is undercut by photography circa the Age of Aquarius.

Frankly, the MWEC is a VW bus chugging along the electronic superhighway. Few twentysomethings will buy it because of the price, while most will see it via their parents, purchasing it for the nostalgia factor. Mom and Dad will groove on "How and Why to Make a User-Friendly Sidewalk Telescope" or "Getting Your Kids to Say 'No' in the '90s When You said 'Yes' in the '60s." ■

## Rushing to Paradise

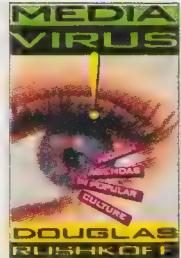
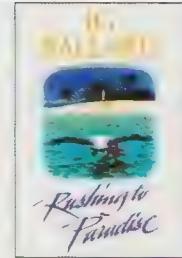
BY J.G. BALLARD  
FLAMINGO  
REVIEWED BY ASHLEY CRAWFORD

**J.G.** Ballard's visions of the future are generally infused with a sense of dread based on environmental calamity. In *The Drowned World* (1961) the Earth is flooded in an extreme vision of the greenhouse effect, while in *The Drought* (1990) the world is bleached dry. In all his novels the effects upon the future's environment are stages set to explore the psychological states of his characters, and invariably they are claustrophobic and often nightmarish.

*Rushing to Paradise*, however, is set in the present, but a present which is no less chilling than his more futuristic scenarios. *Paradise* is an unusual twist in the Ballard oeuvre. Tangible realities are rare in his writing; there is little 'factual' data to grasp, which consolidates the sense of disorientation his characters so often suffer from. However, in his latest offering Ballard offers a plethora of real-time events, political movements and social issues embodied in the frenetic central figure of Dr Barbara Rafferty.

Rafferty embraces a variety of social issues and her obsessions are Ballard's ballistic missile aimed at extremist groups ranging from euthanasia advocates through to radical environmentalists. When Dr Barbara turns environmentalist she also becomes fascistic, controlling her small band of eco-terrorists with an iron will, storming the deserted Pacific atoll of Saint-Esprit to 'save' the 'endangered' albatross with the vigor of Washington crossing the Rubicon. The atoll won, Dr Barbara turns her attentions to further 'ideals,' such as a world without men.

The events in *Rushing to Paradise* are viewed through the eyes of naive 16 year old, Neil Dempsey, who is seduced by the power of the older woman. Dempsey seems a symbol of the public at large, trusting the actions of the 'idealist' even when his own life is endangered. Dempsey unfalteringly follows Dr Barbara through her ever-shifting alliances and causes, acting as both audience and slave.

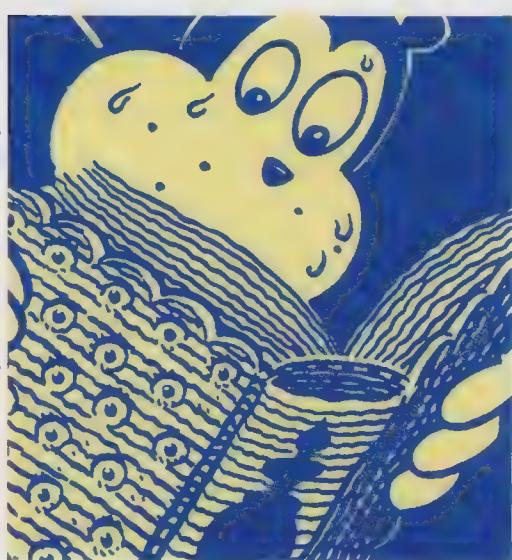


While Ballard has set this psycho-drama in the 'present,' his targets are issues that will impact decidedly on the long-term future. If in some senses his previous works could be taken as grim warnings on the fate of planet Earth, *Rushing to Paradise* can be read equally as a warning to a gullible public seduced by the charisma of outspoken social protesters who, despite their 'politically correct' causes, and media savvy, may simultaneously be guilty of proposing a bleaker future than their acolytes realize.

Ballard's work has often, usually misleadingly, been classified as science fiction. However, like William Burroughs, his books are often searing comments on society and humankind. In *Rushing to Paradise*, Ballard has gone a step further than before, practically listing every socio-political issue and then blasting them apart. What results is high farce, from the media coverage of the 'rescued' Pacific Atoll through to a vision of feminism that is pure fascism.

Ballard's cynicism has given birth to a brilliant satire which will inevitably anger feminists, animal rights activists, supporters of euthanasia, environmentalists and much of the populous. However it is also an extraordinary psychological thriller that is sure to consolidate his reputation as one of the most original writers working today. ■

Frank's Real Pals: Jim Woodring from Millenium Whole Earth Catalog



## Media Virus: Hidden Agendas in Popular Culture.

BY DOUGLAS RUSHKOFF

RANDOM HOUSE

REVIEWED BY DARREN TOFTS

Following on from *The GenX Reader* and *Cyberia: Life in the Trenches of Hyperspace*, *Media Virus* focuses on what it means to grow up in a society where media no longer reflects the world (or what used to be called 'reality'), but constitutes the very fabric of life itself.

The genetic struggle for control within the body politic of popular culture obsesses Rushkoff. The viral agents he calls "memes" are cluster bombs of subversion, charged events, ideas, practices and attitudes which infiltrate mainstream media, latching onto them like a parasite colonizing a host cell. These are the hidden agendas of his title, concealed signals awaiting recognition and appropriation by the battalions of media savvy GenXers, whom Rushkoff portrays as a cross between media junkies and postmodern philosophers. Rushkoff's own agenda is clear. As ironically self-aware agents within an imposed media culture we should actively seek viral infection. Infection makes people think, and promises social change through the awareness of alternatives to the uniform reality and mind control constructed by "them," the insidious "engineers of consumerism."

Unfortunately, Rushkoff's polemic is tired and doctrinaire, and the undertow of conspiracy-theory that flows through the book is in no way qualified by the formulaic simplicity with which countercultural memes are injected into mainstream veins, and go to work transforming dupes into deconstructionists. He is much more engaging when he focuses on examples, and addresses the kinds of viral activity swarming in the "primordial soup" of popular culture. His typology ranges from "guerrilla-style" and "tactical media" (the Rodney King video, filming activism with camcorders), to alternative communities on the electronic frontier (bulletin boards, newsgroups on the Net) to more aggressive forms of insurgence (eco-terrorism, 'zines about bomb-making and revenge). ■

Frank's Real Pals: Jim Woodring from Millenium Whole Earth Catalog



Kids' TV, the Trojan horse in these media wars, is where Rushkoff finds the most potent strains of subversive thinking – the *Simpsons* virus, the Pee-wee Herman virus, the *Ren and Stimpy* virus. Subversive because apparently innocuous, Kids' TV, and especially cartoon shows, explode boundaries that would remain rigidly intact in other genres. The new world disorder of John Kricfalusi may well have been designed to destroy the minds of America, but it is the particularly virulent *Beavis and Butt-head* "contagion" that emerges as the apotheosis of GenX irony and skepticism.

Beavis and Butt-head, the two MTV nerds who watch MTV with knowing detachment, are also an instance of the book's most compelling theme – media's fixation with media.

Although *Media Virus* is a book about American culture, most of its frames of reference will be recognizable to people from countries where American television is a fact of life. This detail, in itself, is the most persuasive illustration of Rushkoff's argument. ■





# artificial flavoring

BY LAURIE GWEN SHAPIRO

The feminist writer George Sand accepted the future as a *fait accompli*. "If the people of the future are better than us," she wrote in 1834, "they will perhaps look back at us with feelings of pity and tenderness for struggling souls who once divined a little of what the future would bring."

Sitting on the edge of her bed in her Manhattan apartment-cum-editing-studio in 1995, 28-year-old film director lara Lee echoes Sand's sentiments: "You can't put a stop to technology. The issue becomes, 'how can we guide ourselves to a better future? How can we write a constitution for the future?'"

Lee has just finished *Synthetic Pleasures*, the award-winning director's first feature length 16 millimeter documentary which attempts to divine a view of the future from the 1990s. The film is an electronic road movie whose frenetic editing technique replaces a traditional film narrative; the quick pace coupled with a techno soundtrack simulates the intensity of a manufactured world.



**Special Effects Holidays:** While storms rage outside, Japanese bask in the controlled environs of Seagaia, an indoor beach. Also available to holiday makers is SSAWS (Spring, Summer, Autumn, Winter, Snow) for indoor skiing.

*Synthetic Pleasures* begins with an extreme example of humankind's effort to tap nature's power: a memorable image of a Japanese indoor ski slope and indoor beach. While a horrific storm rages outside Seagaia (aka Ocean Dome), inside individuals continue to sun bathe and surf.

Lee cuts to a scene featuring the chair of philosophy at New York University, Bob Garland. "We distill these parts of the experience which are pleasant, positive, danger-free," Garland says of these controlled environments. "We don't need to worry about the jellyfish in the water, we don't need to worry whether or not the sun is really going to be out, because we create an environment that is essentially optimal."

Among the many others who ponder the unauthentic around us are Timothy Leary, R.U. Sirius, editor-in-chief of *Mondo 2000* magazine, DNA scientist Robert Pollack, and Virtual Reality pioneer Howard Rheingold.

Lee leads us to Las Vegas' cyber chapels; to the

The Beauty Myth: Performance artist Orlan has had nine cosmetic operations to transform her likeness to that of selected art works: the chin of Botticelli's *Venus*, eyes of Gerome's *Psyche* and the mouth of Boucher's *Europa*.



controversial Biosphere project, in Arizona; and then on to the CAD (Computer Animated Design) Institute in Phoenix, the first institution to offer a degree in Virtual Reality.

The next section turns with "pity and tenderness" to the obsession with the body and the ability to change our anatomy through previously unimaginable avenues such as genetic engineering and plastic surgery. French performance artist Orlan, who is using her own body as her canvas, intones to camera: "I don't do plastic surgery to enhance my beauty or my age, but to get a total transformation of my look and identity. I want to prove that the body is obsolete, just a costume."

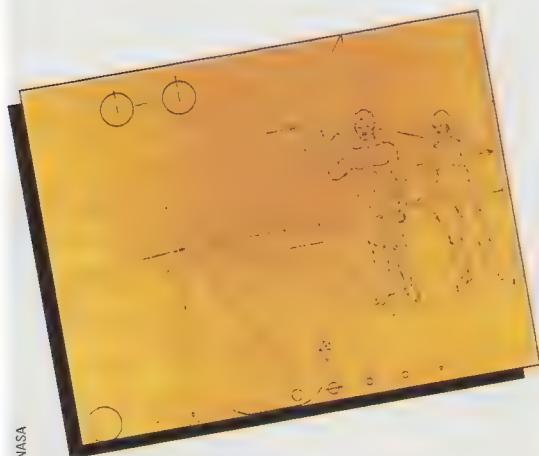
Finally, the film examines the increasing ability of humans to change their identities through such mood-altering drugs as the now-ubiquitous Prozac, which even Princess Di is said to have a prescription for. Says one Prozac user: "If you want to be a blonde, you get your hair dyed. If you want to be a peppy blonde, you get your hair dyed and a Prozac prescription."

And how does Lee think future societies will look back on the 1990s? Lee pauses for a few seconds and laughs. "While exponential change is still relative. Think about how the early science fiction writers envisioned the turn of the millennium. In the mid-'90s, we still have cars polluting our highways, not personal jet capsules... There are no Earth colonies on distant galaxies. I think what is happening now in the cyber world is akin to the development of Ford's Model-T. It's all so primitive."

Several segments of *Synthetic Pleasures* are already available on the Net, including a 10 second segment from the indoor beach. Lee hopes the entire film will eventually be available for downloading, "if anyone has the patience to do that." Lee can be contacted by world wide web at: <http://www.panix.com.liao.sp>

THIS YEAR THE MOST DETERMINED SEARCH FOR EXTRATERRESTRIAL INTELLIGENCE BEGINS.  
IF LIFE IS FOUND IN THE STARS IT COULD MARK THE END OF SOCIETY AS WE KNOW IT.

# life off earth



NASA

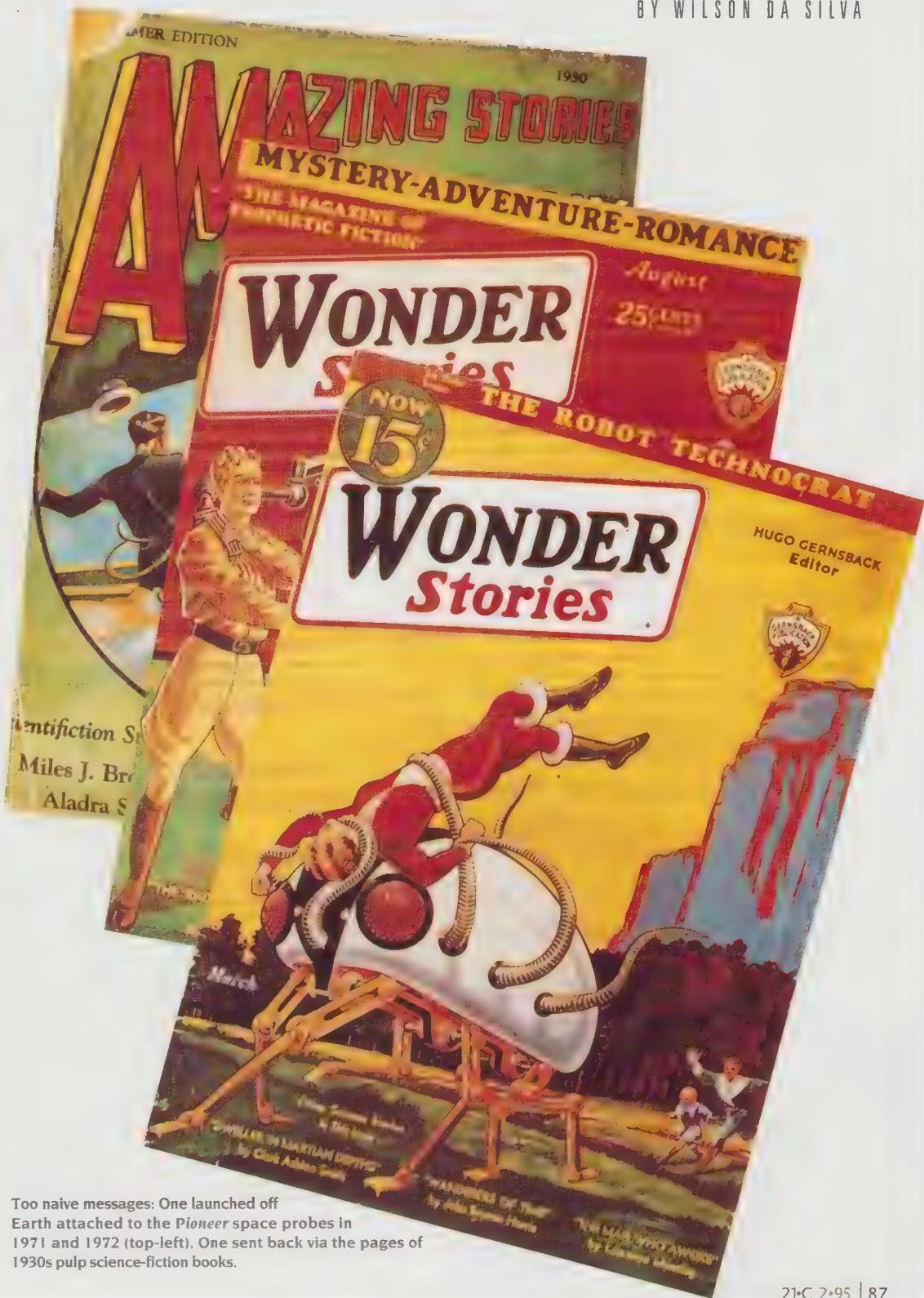
*"As the Secretary-General of the United Nations, an organization of 147 member states who represent almost all of the human inhabitants of the planet Earth, I send greetings on behalf of the people of our planet. We step out of our solar system into the universe, seeking only peace and friendship; to teach if we are called upon; to be taught if we are fortunate."*

**I**t's a nice gesture: an interstellar greeting card from Earth aboard the two *Voyager* space probes sent to all those alien civilizations out there. But not everybody thinks so.

"These are like giant dinner invitations being sent into interstellar space... with all sorts of clear messages about where Earth is," says Michael Archer, professor of biological science at Sydney's University of New South Wales. "Come over here to Earth, there's lots of good things to eat."

Archer is a scientist with severe qualms about the impact of extraterrestrial contact. He isn't the only one. On November 16, 1974, the 305 meter Arecibo radiotelescope in Puerto Rico transmitted a message aimed at the distant globular cluster M13. The 169-second message described some characteristics of life on Earth. At the time, U.S. diplomat Michael A. G. Michaud considered the exercise a political act, stating that such a monumental decision should be made openly, "with the involvement of public authorities," and not be left to scientists alone. Sir Martin Ryle, a Nobel laureate and then-Astronomer

BY WILSON DA SILVA



Too naive messages: One launched off Earth attached to the *Pioneer* space probes in 1971 and 1972 (top-left). One sent back via the pages of 1930s pulp science-fiction books.

**Astronomy Lessons: Studying neighboring planets in our solar system has helped SETI scientists develop comparative planetology theories that underpin the search for extraterrestrial intelligence. Artist's impression of a Voyager flyby of Uranus.**



Julian Baum/SPL

Royal of Britain, wrote to leading astronomers and argued that it was hazardous to reveal our existence and location to the universe. For all we know, he said, "any creatures out there are malevolent or hungry," and once they knew of us, "they might come to attack or eat us." Ryle urged that the messages be stopped, and even asked the International Astronomical Union to ban any future transmissions.

At a scientific workshop in Sydney last year, paving the way for the international Project Phoenix – the most systematic search ever undertaken – seemingly staid and well-adjusted scholars locked horns. Some regard the search as ludicrous, others as a noble goal in principle, but in reality, a waste of time. Biologists say life on Earth has arisen through such a quixotic mix of chance and chaos that it is unlikely to be mirrored anywhere else; as for *intelligent* life, forget it. Cognitive scientists – at least some of them – say that our brains are such bizarre and quirky instruments, a mish-mash of our evolutionary past, that we can never hope to understand alien signals.

But a growing band of scientists, including Carl Sagan, Frank Drake, Paul Horowitz and Philip Morrison, believe that to question if life exists beyond Earth is legitimate, and that we at last have the technology to test the theory.

"There's a sort of hazard as a scientist that you lose a bit of credibility by doing this sort of research," says Dr Ray Norris, an astrophysicist at the Australia Telescope array who spoke at the workshop. "It smacks of UFOs and science fiction. My view is that it is real science. We're trying to answer questions about the universe, and to ask if there's life out there must be a valid question."

15 million channels and nothing on? The 64 meter Parkes radio telescope in Australia searches the skies for extraterrestrial signals

Norris sees the search as bringing major benefits to humanity: "We have a number of problems on this planet right now. People are starving, war and pollution. The chances are that another civilization will probably have confronted similar problems. The interesting thing is, if this civilization is more advanced than us, then we know it's been through all this and hasn't wiped itself out. And that gives us a ray of hope – mankind can survive."

We may well know in the next few years. In the dry scrub of central New South Wales, amid fields of wheat, lies the Parkes radiotelescope. The 64-meter dish is the first to begin an unprecedented, systematic search for radio signals from our local stellar neighborhood – the nearest 1,000 light years. For five months in 1995, the dish will scan the first 200 Sun-like stars for signals, listening across 15 million channels simultaneously. It will later be joined by the Arecibo radiotelescope the giant dish whose parabola blankets a whole valley. Another smaller radiotelescope is planned in the northern hemisphere, and the three will conduct observing stints over the next 10 years.

In the last 35 years, there have been some 60 SETI [Search for Extraterrestrial Intelligence] projects conducted in the United States, Russia, France, Australia, Argentina and Canada; some have been sporadic stints while others have been ongoing. None have yielded definitive signs of intelligent life, although there have been 435 "candidate signals" detected. All of the these were sporadic – they were interesting, but unclear, and drifted or stopped before researchers could study them long enough to determine if they were natural or artificial.

SETI proponents expect three types of signals to be coursing through the cosmos: "local broadcast" communications from the home planet; "long-distance calls" between two or more planetary civilizations, or between the home world and its outlying colonies; and "beacons," meant to announce to emerging societies that they are not alone. The problem with the first two is that, if you're looking to eavesdrop, the dish must be pointed at the right star at the exact time a transmission is sent. That's a long shot, so most searches have focused on beacons. But even then, the

frequency of the broadcast must be known, otherwise it may zip right past the radiotelescope undetected – never mind knowing the modulation so you can decode it.

Space is incredibly noisy on the radio spectrum; there are stars crashing into stars and suns collapsing. To search the whole microwave region spectrum, between 300 megahertz and 300 gigahertz, the number of possible 'cells' that would have to be searched is roughly 300,000,000,000,000,000,000. Luckily, there is a narrower window, between 1 and 60 gigahertz, that is relatively quiet, and where it would be easiest to detect a faint microwave radio signal from across space against the natural background radiation. So far, all of the search programs put together have covered less than a trillionth of all of the cells that could be searched.

Norris, one of the scientists on the Phoenix project, is not fazed by the enormity of the odds. "When you look at what we've done [so far], it's not surprising we haven't detected anything yet. You have to look very, very hard. It's not clear even now that we have the technology to do it properly. I think we're just getting to the stage where we have a fighting chance."

The assumption of SETI researchers is that the laws governing the universe are the same everywhere. If so, communication may be possible by referring to those things we might have in common with extraterrestrials – physics, mathematics, and so on – thus building a rudimentary 'language.' But not everyone is optimistic. Professor Nicholas Rescher, a philosopher at the University of Pittsburgh, contends that extraterrestrials are extremely unlikely to have any type of science that would be recognizable to us, despite sharing the same 'universal' laws. They will be very different organisms, with different needs, senses, and behavior; they will live on planets strikingly different from our own. Maybe in environments where science and technology are unnecessary. He argues that several species have flourished on Earth without developing 'intelligence.' The science of an alien civilization may also reflect the way they perceive nature, and it might be impossible to fathom their view of the universe or approach to science.



**Earth's Greatest Hits:** The gold plated copper record *The Sounds of Earth* (far right), features images of life on Earth, music and greetings in 60 languages. It is claimed that it will last a billion years. (Right) Packaging the record and the American flag for distribution via the *Voyager 2* space probe, 1977.



NASA/SPL

However, artificial-intelligence pioneer Marvin Minsky, of Boston's Massachusetts Institute of Technology, argues that intelligent extraterrestrials "will think like us, in spite of different origins." This is based on the concept that all intelligent problem-solvers are subject to the same ultimate constraints – limitations of space, time and resources. In order for life to develop successful strategies for dealing with the world, they must be able to represent the situations they face, and they must have processes for manipulating those representations.

According to Minsky, extraterrestrials will have evolved thought processes and communication strategies that will mirror our own, to a degree that will enable us to comprehend them. SETI proponents largely agree with Minsky, choosing also to believe that there is some "convergence" in the interpretations of the physical laws in all galactic civilizations.

Assuming an alien signal is detected, how will the world react? The first images people conjure up – flying saucers and spinning lights – follow a steady diet of fictional visions; from films like *Earth Versus the Flying Saucers* in the '50s to *Alien* in the '80s. Even U.S. presidents get into the act: "I am convinced that UFOs exist, because I have seen one," Jimmy Carter told reporters in 1976.

Possible reactions to contact have been defined by anthropologist Ben R. Finney of the University of Hawaii as being either "paranoid" or "pronoid": either people will be excessively fearful and distrustful of aliens, or too trusting. Much of science fiction has followed the paranoid theme. Perhaps influenced by Darwinism at the end of the 19th century, H.G. Wells wrote about the invasion of Earth in his classic *The War of the Worlds* in 1898. Wells cast the alien as a natural enemy of humanity, and this quickly became the stereotype. This mind-set went on to dominate contemporary thinking on extraterrestrials: in the early 1960s, the Brookings Institution delivered a report to NASA concluding that "the discovery of life on other worlds could cause Earth's civilization to collapse." It still goes on today; medical anthropologist Melvin Konner, arguing against NASA's SETI program, said that "evolution predicts the existence

of selfishness, arrogance and violence on other planets even more surely than it predicts intelligence." He considered it philosophically and scientifically naive to think that advanced extraterrestrials might want to benevolently pass on their galactic wisdom to us, and argued that the likely result of contact could be the most cataclysmic disaster to ever befall our species. Aliens would be just as brutish with less advanced civilizations as we have been with our own kind, and we would end up being treated the way we have treated "rhesus monkeys, cows, dogs and dodos."

The "pronoid" school of thought is found in the writings of William Newman and Carl Sagan, and in films like *ET*. The pronoid school suggests that there may be universal impediments to cosmic imperialism. They argue that advanced civilizations with long histories *must* have learned how to be benign or else they would have wiped themselves out long ago. To answer the 'cannibalistic arguments' of the paranoid faction, Sagan says that extraterrestrial carnivores, having evolved under completely different circumstances over billions of years, are unlikely to find the sequences of amino acids in human proteins especially tasty or nourishing. It would be cheaper and easier to "synthesize proteins in the amino acid sequences favored by extraterrestrial gastronomers than to muster a luncheon expedition to Earth."

Authors Arthur C. Clarke and the late Isaac Asimov, along with scientists Frank Drake, Paul Horowitz, and Philip Morrison, have opined that societies "with superior science and inferior morals" would not stand the test of time. Either way, it is unlikely that more-advanced civilizations would place state-of-the-art knowledge at the disposal of an unknown and morally underdeveloped society, since it could be a threat to their existence.

Arthur C. Clarke once said that the technical capability of a sufficiently advanced civilization will, to humankind, be indistinguishable from magic; an extraterrestrial civilization capable of building beacons transmitting strong signals across the cosmos will obviously be highly advanced. However, popular culture has pre-empted 'their' arrival – in

supermarket tabloids, not only do extraterrestrials visit with surprising frequency, they often have useful liaison staff such as Elvis Presley.

With or without Elvis, a discovery alone will have enormous consequences. "Clearly the discovery of strong evidence for an extraterrestrial intelligence would transform the vision we have of humanity," contends Professor Lawrence Cramb, head of astrophysics at the University of Sydney. Discovering that humanity is no longer alone will be seen by some as liberating, by others as a marker for the collapse of established structures. Religions, in particular, could have a tough time: Do aliens have a soul? Were they created by a God? If they are unaware of a God, does this challenge his or her universality? Some think that the detection of a signal alone could obliterate faiths, if they cannot find a way to integrate the new reality into the dogma.

Some argue that the consequences of extraterrestrial contact are so potentially devastating that we should shut all search programs down immediately. When Sir Martin Ryle raised an almighty ruckus about the first directed transmission into space, SETI pioneer Frank Drake wrote to him, saying that it was too late to start worrying: "The deed is done, and repeated daily with every television transmission, every military radar signal, every spacecraft command.... They're too far away to pose a threat. I think that hostile tribes bent on war, be they terrestrial or extraterrestrial, destroy themselves with their own weapons long before they have any notion of how to attempt interstellar travel. The more peaceful nations, who study science and have perhaps cracked the secret of immortality, are more likely to be benevolent, shy, and wary of contact for their own reasons."

Even if no signal is detected, we will have something to learn. Says Cramb: "I happen to think there aren't other intelligent beings in the universe, and I think an increasing demonstration that we are alone will have an impact on the collective consciousness and the part humanity has to play in the world. The obligation (will be) on humanity to protect our natural environment." ■

AS THE WORLD'S MILITARY-INDUSTRIAL COMPLEX SEARCHES FOR A REASON FOR BEING IN A POST-COLD WAR ENVIRONMENT, AN ENTICING PROSPECT BECKONS: THE EXPLORATION AND POTENTIAL SETTLEMENT OF THE WORLD NEXT DOOR, MARS.

# RED PLANET

BY CARL SAGAN

Sometime soon, perhaps just around the corner, there will be a nation – or a consortium of nations – that will make the next major step in the human venture into space. Perhaps it will be brought about by circumventing bureaucracies and making efficient use of present technologies. Perhaps it will require new technologies, transcending the great blunderbuss chemical rockets. The crews of these ships will set foot on new worlds. The first baby will be born somewhere up there. Early steps toward living off the land will be made. We will be on our way. And the future will remember.

Tantalizing and majestic, Mars is the world next door, the nearest planet on which an astronaut or cosmonaut could safely land. Although it is sometimes as warm as a New England October, Mars is a chilly place, so cold that some of its thin carbon dioxide atmosphere freezes as dry ice at the winter pole.

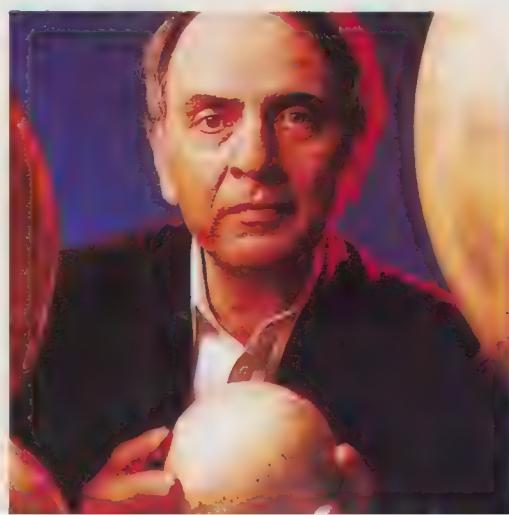
It is the nearest planet whose surface we can see with a small telescope. In all the solar system, it is the planet most like Earth. Apart from flybys, there have been only two fully successful missions to Mars: in 1971, and in 1976. They revealed a deep rift valley that would stretch from New York to San Francisco;

immense volcanic mountains, the largest of which towers 24 kilometers above the average altitude of the Martian surface, almost three times the height of Mount Everest; an intricate layered structure in and among the polar ice, resembling a pile of discarded poker chips, and probably a record of past climatic change; bright and dark streaks painted down on the surface by windblown dust, providing high-speed wind maps of Mars over the past decades and centuries; vast globe-girdling dust storms; and enigmatic surface features.

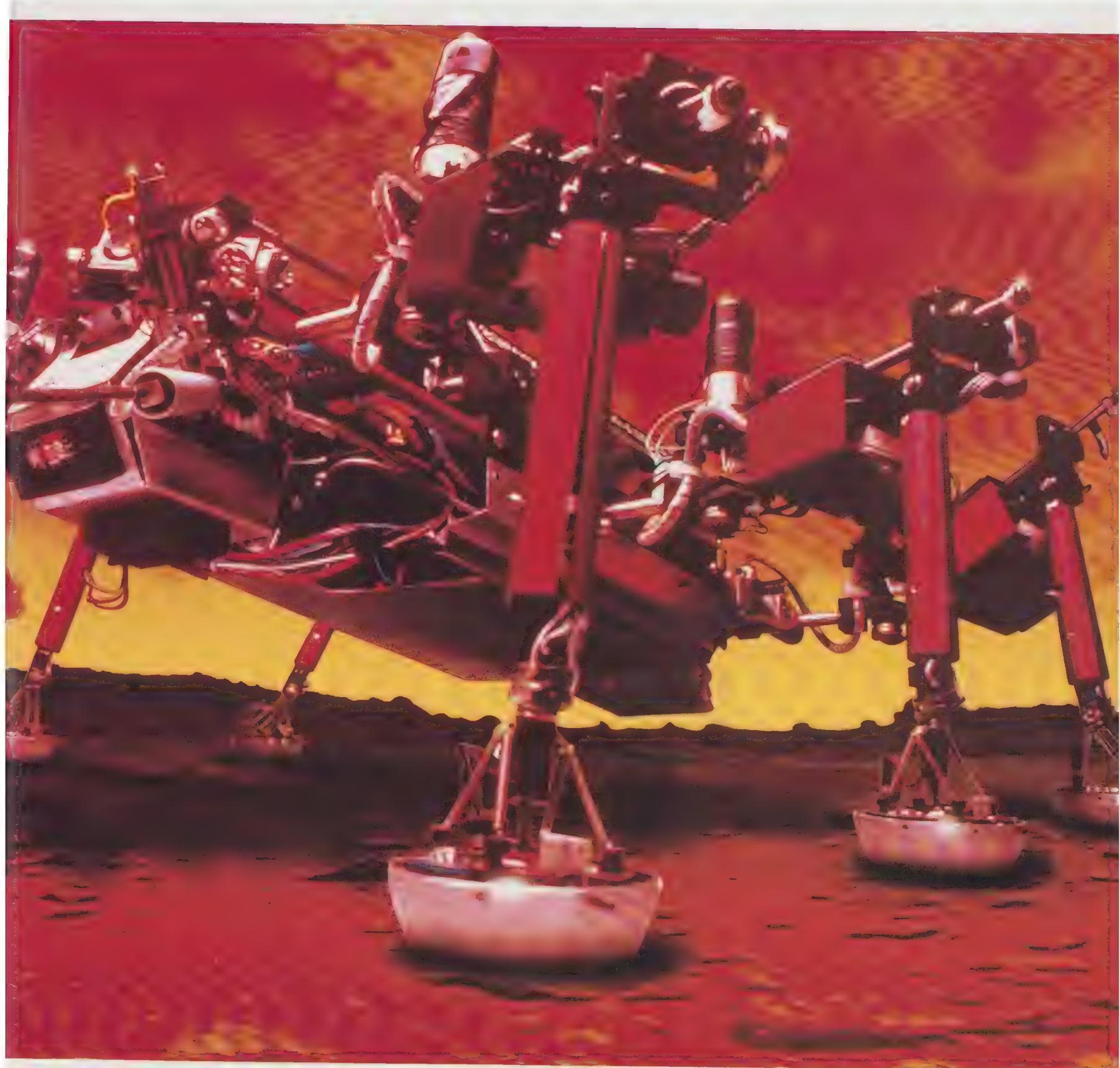
*"Mars beckons us, a storehouse of scientific information – important in its own right but also for the light it casts on our own planet" – Carl Sagan*



Photo courtesy Bruce Frisch/Digital imaging by Greg O'Connor



Portrait Bill Bernstein/Orbita



Total Recall: Between 1996 and 2003, 25 spacecraft will be sent to Mars. On board will be robot explorers (like these developed by Rodney Brooks of MIT) weighing little more than a kilogram, which can gather information from dangerous Martian locales and send it back to Earth.



**H**undreds of sinuous channels and valley networks dating back several billion years can be found, mainly in the cratered southern highlands. They suggest a previous epoch of more benign and Earth-like conditions, very different from what we find beneath the tenuous and frigid atmosphere of our time. Some ancient channels seem to have been carved by rainfall, some by underground sapping and collapse, and some by great floods that gushed up out of the ground. Rivers were pouring into and filling great thousand-kilometer-diameter impact basins that today are as dry as dust. Waterfalls dwarfing any on Earth today cascaded into the lakes of ancient Mars. Vast oceans, hundreds of meters – perhaps even a kilometer – deep, may have gently lapped shorelines barely discernible today, would have been a world to explore. Sadly, we are four billion years too late.

Mars beckons us, a storehouse of scientific information – important in its own right but also for the light it casts on our own planet. There are mysteries waiting to be resolved about the interior of Mars and its mode of origin, the nature of volcanoes on a world without plate tectonics, the sculpting of landforms on a planet with sandstorms undreamt of on Earth, glaciers and polar landforms, the escape of planetary atmospheres, the capture of moons – the list is endless. If Mars once had abundant water and a clement climate, what went wrong? How did an Earth-like world become so parched, frigid, and comparatively airless? Is there something here we should know about our own planet?

Humans have trodden this path before. Ancient explorers would have understood the call of Mars. But scientific exploration today does not require a human presence – we can send smart robots. They are far cheaper, they don't talk back, you can send them to much more dangerous locales and, with some chance of mission failure always present, no lives are put at risk.

Spacefaring nations have clearly decided that the time is ripe to return robot explorers to Mars. Mission designs change, new nations enter the field, and old nations find they no longer have the resources. Even

already funded programs cannot always be relied upon. But current plans do reveal something of the intensity of effort and the depth of dedication.

There are tentative plans by the United States, Russia, France, Germany, Japan, Austria, Finland, Italy, Canada, the European Space Agency, and other entities for a coordinated robotic exploration of Mars. In the seven years between 1996 and 2003, a flotilla of some 25 spacecraft – most of them comparatively small and cheap – are to be sent from Earth to Mars. There will be no quick flybys among them; these are all long-duration orbiter and lander missions. The United States will re-fly all of the scientific instruments that were lost on the ill-fated *Mars Observer*, the advanced planetary explorer which failed on its way to Mars. Planned Russian spacecraft will contain particularly ambitious experiments involving some 20 nations. Communications satellites will permit experimental stations anywhere on Mars to relay their data back to Earth. Penetrators screeching down from orbit will punch into the Martian soil, transmitting data from underground. Instrumented balloons and roving laboratories will wander over the sands of Mars. Microrobots weighing little more than a kilo will scamper across the landscape. Landing sites are being planned and coordinated. Instruments will be cross-calibrated. Data will be freely exchanged. There is every reason to think that in the coming years, Mars and its mysteries will become increasingly familiar to the inhabitants of planet Earth.

*In the command center on Earth, in a special room, you are helmeted and gloved. You turn your head to the left, and the cameras on the Mars robot rover turn to the left. You see, in high-definition and in color, what the cameras see. You take a step forward, and the rover walks forward. You reach out your arm to pick up something shiny in the soil, and the robot arm does likewise. The sands of Mars trickle through your fingers.*

It may sound like an arcade game. But this will be the future of planetary exploration. The one difficulty with such 'remote reality' technology is that all this must occur in tedious slow-motion: the round-trip travel time of the up-link commands from Earth to Mars, and the down-link data stream returned from

Mars to Earth, may take half an hour or more. But this is something we can learn to do. We can learn to contain our exploratory impatience, if that's the price of exploring Mars. The rover can be made smart enough to deal with routine contingencies. Anything more challenging, and it makes a dead stop, puts itself into a safeguard mode, and radios for a human controller to take over.

Picture it: roving, smart robots, each of them a small scientific laboratory, landing in the safe but dull places and wandering to view close-up some of the profusion of Martian wonders. Perhaps every day, a robot would rove to its own horizon; each morning we would see close-up what had yesterday been only a distant eminence. The lengthening progress of a traverse route over the Martian landscape would appear on news programs and in schoolrooms. People would speculate on what will be found. Nightly newscasts from another planet, with their revelations of new terrains and new scientific findings, would make everyone on Earth a party to the adventure.

Then there's Martian virtual reality, brought to a suburban VR drome near you; stored on computer, the data returned from the mission can be fed into your helmet, gloves and boots. You experience what it would be like – pink skies, fields of boulders, sand dunes stretching to the horizon where an immense volcano looms; you hear the sand crunching under your boots, you turn rocks over, dig a hole, sample the thin air, turn a corner, and come face to face with... whatever new discoveries await us on Mars. All of these exact copies of what is really on Mars, and all experienced from the safety of a virtual reality salon. This is not we explore Mars; but it does allow the joys of exploration to be shared across humanity as never before.

Will humans, perhaps a few lucky ones, ever experience this directly? With the continuing investment in robotics and artificial intelligence, sending humans to Mars can't be justified by science alone. And many more people can experience the 'virtual Mars' than could possibly be sent to the real one. We can do very well with robots. If we're going to send people, we'll need a better reason than science and exploration.



In the not too distant future, you are in a special room, you are helmeted and gloved. You turn your head to the left, and the video screen shows what the cameras see. You turn your head to the right, and the video screen shows what the cameras see. You turn your head to the left. You see, in high-definition and in color, what the cameras see. You take a step forward. You reach out your arm to pick up something shiny in the soil, and the robot arm does likewise. The sands of Mars trickle through your fingers.

In the 1980s, I thought I saw a coherent justification for human missions to Mars. I imagined the United States and the then-Soviet Union, the two Cold War rivals that had put our human civilization at risk, joining together in a far-seeing, high-technology endeavor that would give hope to people everywhere. I pictured a kind of program in reverse, in which cooperation, not competition, was the driving force, in which the two leading spacefaring nations would together lay the groundwork for a major advance in human history – the eventual settlement of another planet. The symbolism seemed so apt. The same technology that can propel apocalyptic weapons from continent to continent would enable the first human voyage to another planet. It was a choice of fitting mythic power: to embrace the planet named after, rather than the madness ascribed to, the god of war.

We succeeded in interesting Soviet scientists and engineers in such a joint endeavor. Roald Sagdeev, then director of the Institute for Space Research of the Soviet Academy of Sciences in Moscow, was already deeply engaged in international cooperation on Soviet robotic missions to Venus, Mars, and Halley's Comet, long before the idea became fashionable. Projected joint use of the Soviet space-station and the -class launch vehicle made cooperation attractive to the Soviet organizations that manufactured these items of hardware; they were otherwise having difficulty justifying their wares. Through a sequence of arguments (helping to bring the Cold War to an end being chief among them), the Soviet leader Mikhail S. Gorbachev was convinced. During the December 1987 Washington summit, Gorbachev, asked what was the most important joint activity through which the two countries might symbolize the change in their relationship, unhesitatingly replied, "Let's go to Mars together."

But President Ronald Reagan's administration was not interested. Cooperating with the Soviets, acknowledging that certain Soviet technologies were more advanced than their American counterparts, making some American technology available to the Soviets, sharing credit, providing an alternative for the arms manufacturers – these were not to the

administration's liking. The offer was turned down. Mars would have to wait.

Now times have changed. The Cold War is over. The Soviet Union is no more. The benefit derived from the two nations working together has lost some of its force. Other nations – especially Japan and the constituent members of the European Space Agency – have become interplanetary travelers. Many just and urgent demands are levied on the discretionary budgets of the nations.



Picture courtesy of U.S. Geological Survey, Arizona

**Remote-Control Exploration:** In the not too distant future, Robot rovers like Rocky IV will collect information and send it back to Earth. They may also provide virtual experiences to 'feel' the red sands of Mars via a data glove.

But the powerful heavy-lift booster still awaits a mission. The workhorse rocket is available. The space-station – with a crew aboard almost continuously – still orbits the Earth every hour and a half. Despite internal turmoil, the Russian space program continues vigorously. Cooperation between Russia and the United States in space is accelerating. A Russian cosmonaut, Sergei Krikalev, in 1994 flew on the shuttle – a one-week shuttle ride which must have seemed rather ordinary to Krikalev, who had already logged 464 days aboard the space-station. U.S. astronauts will visit. American instruments – including

one to examine the oxidants thought to destroy organic molecules in the Martian soil – are to be carried by Russian space vehicles to Mars. The Russians have offered to include a U.S. orbiter in a forthcoming -launched multi-payload mission to Mars. American and Russian capabilities in space science and technology mesh. Each is strong where the other is weak. This is a marriage made in heaven – but one that has been surprisingly difficult to consummate.

On September 2, 1993, an agreement to cooperate in depth was signed in Washington by U.S. Vice-President Al Gore and Russian Prime Minister Viktor Chernomyrdin. The Clinton administration has ordered NASA to redesign the U.S.-led international space-station so it is in the same orbit as and can be mated to it: Japanese and European modules will be attached, as will a Canadian robot-arm. The designs have now evolved into what is called space-station , involving almost all the spacefaring nations – China being the most notable exception.

In return for U.S. space cooperation and an infusion of hard currency, Russia in effect agreed to halt its sale of ballistic missile components to other nations, and generally to exercise tight controls on its export of strategic weapons technology. In this way, space becomes once again, as it was at the height of the Cold War, an instrument of national strategic policy. But cooperative programs save money in the long term, draw upon the extraordinary scientific and engineering talent worldwide, and provide inspiration for a global future. There may be fluctuations in national commitments. We are likely to take backward as well as forward steps. But the overall trend seems clear.

Despite growing-pains, the space programs of the two former adversaries are beginning to join. It is now possible to foresee a world space-station – not of any one nation but of the planet Earth – being assembled at 51 degrees to the equator and a few hundred miles up. A dramatic joint mission, called "Fire and Ice," is being discussed – in which a fast flyby would be sent to Pluto, the last unexplored planet; but to get there, a gravity-assist 'slingshot' maneuver using the Sun would be employed, in the course of which small



# If we are to send people, it must be for a very good reason – and with a realistic understanding that almost certainly we will lose lives.

probes would actually enter the Sun's atmosphere. And we seem to be on the threshold of a World Consortium for the scientific exploration of Mars. It very much looks as though such projects will be done cooperatively, or not done at all. Whether there are valid, cost-effective, broadly supportable reasons for people to venture to Mars is an open question. Certainly there is no consensus.

I would argue that if we are not eventually going to send people to worlds as far away as Mars, we have lost the chief reason for a space-station – a permanently (or intermittently) occupied human outpost in Earth orbit. A space-station is far from an optimum platform for doing science – either looking down at the Earth, or looking out into space or for utilizing microgravity; the very presence of astronauts messes things up. For military reconnaissance it is much inferior to robotic spacecraft. There are no compelling economic or manufacturing applications. It is expensive compared

to robotic spacecraft. And of course it runs some risk of losing human lives. Every shuttle launch to help build or supply a space-station has an estimated one or two per cent chance of catastrophic failure.

Previous civilian and military space activities have littered low Earth orbit with fast-moving debris that sooner or later will collide with a space-station (although, so far, has had no failures from this hazard). A space-station is also unnecessary for human exploration of the Moon. got there very well with no space-station at all. With or class launchers, it also may be possible to get to near-Earth asteroids or even Mars without having to assemble the interplanetary vehicle on an orbiting space-station.

A space-station could serve inspirational and educational purposes, and it certainly can help to solidify relations among the spacefaring nations – particularly the United States and Russia. But the only substantive function of a space-station, as far as I can see, is for long-duration spaceflight. How do humans behave in microgravity? How can we counter progressive changes in blood chemistry and an estimated six per cent bone loss per year in zero

gravity? For a three- or four-year mission to Mars this adds up, if the travelers have to go at "zero g."

These are hardly questions in fundamental biology such as DNA or the evolutionary process; instead they address issues of applied human biology. It's important to know the answers, but only if we intend to go somewhere in space that's far away and takes a long time to get to. The only tangible and coherent goal of a space-station is eventual human missions to near-Earth asteroids, Mars, and beyond. Historically NASA has been cautious about stating this fact clearly, probably for fear that members of Congress will throw up their hands in disgust, denounce the planned U.S.-led international space-station as the thin edge of an extremely expensive wedge.

The failure, and the catastrophic loss of the space shuttle in 1986, remind us that there will be a certain irreducible chance of disaster in future human flights to Mars and elsewhere. The mission, which was unable to land on the Moon and barely returned safely to Earth, underscores how lucky we've been. We cannot make perfectly safe cars or trains, even though we've been at it for more than a century. Hundreds of thousands of years after we first domesticated fire, every city in the world has a service of firefighters bidding their time until there's a blaze that needs putting out. In Columbus' four voyages to the New World, he lost ships left and right, including one-third of the little fleet that set out in 1492.

If we are to send people, it must be for a very good reason – and with a realistic understanding that almost certainly we will lose lives. Astronauts and cosmonauts have always understood this. Nevertheless, there has never been, nor will there ever be, a shortage of volunteers.

But why Mars? Why not return to the Moon? The latter is closer, and we've proved we know how to send people there. My concern is that the Moon, close as it is, is a long detour, if not a dead-end. We've been there. We've even brought some of it back. People have seen the Moon rocks, and, for reasons that I believe are fundamentally sound, they are bored by the Moon. It's a static, airless, waterless, black-sky,

dead world. Its most interesting aspect perhaps is its cratered surface.

Mars, by contrast, has weather, dust storms, its own moons, volcanoes, polar ice caps, peculiar landforms, ancient river valleys, and evidence of massive climatic change on a once Earth-like world. It holds some prospect of past or maybe even present life, and is the most congenial planet for future life – humans transplanted from

Earth, living off the land. None of this is true for the Moon. Mars also has its own legible cratering history. If Mars, rather than the Moon, had been within easy reach, we would not have backed off from manned space flight.

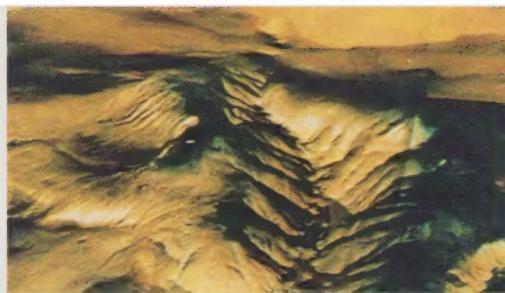
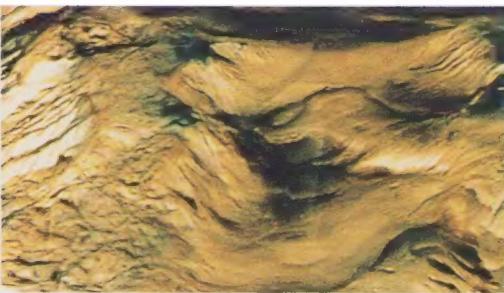
Nor is the Moon an especially desirable test bed or way station for Mars. The Martian and lunar environments are very different, and the Moon is as distant from Mars as is the Earth. The machinery for Martian exploration can at least equally well be tested in Earth orbit, or on near-Earth asteroids, or on the Earth itself – in Antarctica, for instance.

The first human mission to Mars is now probably too expensive for any one nation to pull off by itself. Nor is it fitting that such a historic step be taken by representatives of only a small fraction of the human species. But a cooperative venture among the United States, Russia, Japan, the European Space Agency – and perhaps other nations, such as China – might be feasible in the not too distant future. The international space-station will have tested our ability to work together on great engineering projects in space.

The cost of sending a kilogram no farther away than low Earth orbit is today about the same as the cost of a kilogram of gold. This is surely a major reason we have yet to stride the ancient shorelines of Mars. Multi-stage chemical rockets are the means that first took us into space, and that's what we've been using ever since. We've tried to refine them, to make them safer, more reliable, simpler, cheaper. But that hasn't happened, or at least not nearly as quickly as many had hoped.

So maybe there's a better way: maybe single-stage rockets that can launch their payloads directly to orbit; maybe many small payloads shot from guns or





Picture courtesy of U.S. Geological Survey, Arizona

Viking Longshot: The "Grand Canyon" of Mars, Valles Marineris viewed from the *Viking* spacecraft.

rocket-launched from airplanes; maybe supersonic ramjets. Maybe there's something much better that we haven't thought of yet. If we can manufacture propellants for the return trip out of the air and soil of our destination world, the difficulty of the voyage would be greatly eased.

Once we're up there in space, venturing to the planets, rocketry is not necessarily the best means to move large payloads around, even with gravity assists. Today, we make a few early rocket burns and later midcourse corrections, and coast the rest of the way. But there are promising ion and nuclear/electric propulsion systems by which a small and steady acceleration is exerted. Or, as the Russian space pioneer Konstantin Tsiolkovsky first envisioned, we could employ solar sails – vast but very thin films that catch sunlight and the solar wind, a caravel kilometers wide plying the void between worlds. Such methods are far better than rockets, especially for trips to Mars and beyond.

As with most technologies, when something barely works, when it's the first of its kind, there's a natural tendency to improve it, develop it, exploit it. There's such an institutional investment in the original technology, no matter how flawed, that it's very hard to move on to something better. NASA has almost no resources to pursue alternative propulsion technologies. That money would have to come out of near-term missions which could provide concrete results and improve NASA's success record. Spending money on alternative technologies pays off a decade or two in the future. But we tend to be little interested in the future. This is one of the ways by which initial success can sow the seeds of ultimate failure; it is very similar to what sometimes happens in biological evolution. But sooner or later some nation – perhaps one without a huge investment in marginally effective technology – will develop effective alternatives.

Even before then, if we take a cooperative path, there will come a time – perhaps in the first decades of the new century and the new millennium – when an interplanetary spacecraft is assembled in Earth orbit, in full view on the evening news. Astronauts and cosmonauts, hovering like gnats, guide and mate the

prefabricated parts. Eventually the ship, tested and ready, is boarded by its international crew, and boosted to escape velocity. For the whole of the voyage to Mars and back, the lives of the crew members depend on one another, a microcosm of our actual circumstances on Earth. Perhaps the first joint interplanetary mission with human crews will be only a flyby or orbit of Mars. Earlier, robot vehicles, with aerobraking, parachutes, and retrorockets, will have set gently down on the Martian surface to collect samples and return them to Earth, and to emplace supplies for future explorers. But whether or not we have compelling, coherent reasons, I am sure – unless we destroy ourselves first – that the day will come when we humans set foot on Mars. It is only a matter of when.

According to a solemn treaty, signed in Washington and Moscow on January 27, 1967, no nation may lay claim to part or all of another planet. Nevertheless – for historical reasons that Columbus would have understood well – some people are concerned about who first sets foot on Mars. If this really worries us, we can arrange for the ankles of the crew members to be tied together as they alight in the gentle Martian gravity.

The crews would acquire new and previously sequestered samples, in part to search for life, in part to understand the past and future of Mars and, by association, Earth. They would experiment, for later expeditions, on extracting water, oxygen, and hydrogen from the rocks and the air and from the underground permafrost – to drink, to breathe, to power their machines and, as rocket fuel and oxidizer, to propel them on their return voyage. They would test Martian materials for eventual fabrication of bases and settlements on Mars.

And they would go exploring. When I imagine the early human exploration of Mars, it's always a roving vehicle, a little like a jeep, wandering down one of the valley networks, the crew with geological hammers, cameras, and analytic instruments at the ready. They're looking for rocks from ages past, signs of ancient cataclysms, clues to climate change, strange

chemistries, fossils, or – most exciting and most unlikely – something alive. Their discoveries are televised back to Earth at the speed of light. Snuggled up in bed, you explore the ancient riverbeds of Mars.

I think the experience of living on other worlds is bound to change us. Our descendants, born and raised elsewhere, will naturally begin to owe primary loyalty to the worlds of their birth, whatever affection they retain for the Earth. Their physical needs, their methods of supplying those needs, their technologies, and their social structures will all have to be different.

A blade of grass is a common sight on Earth; it would be a miracle on Mars. Our descendants on Mars will know the value of a patch of green. And if a blade of grass is priceless, what is the value of a human being? The American revolutionary Tom Paine, in describing his contemporaries, had thoughts along these lines: "The wants which necessarily accompany the cultivation of wilderness produced among them a state of society which countries long harassed by the quarrels and intrigues of governments had neglected to cherish. In such a situation man becomes what he ought to be." He sees his species... as kindred.

Having seen at first hand a procession of barren and desolate worlds, it will be natural for our spacefaring descendants to cherish life. Having learned something from the tenure of our species on Earth, they may wish to apply those lessons to other worlds – to spare future generations the avoidable suffering that their ancestors were obliged to endure, and to draw upon our experience and our mistakes as we begin our open-ended evolution into space. ■

"I am sure – unless we destroy  
ourselves first – that the day will come  
when we humans set foot on Mars.  
It is only a matter of when."





"MCLUHAN WAS RESOUNDINGLY WRONG IN HIS FLABBERGASTING ASSERTION THAT TV, UNIVERSALLY REGARDED AS A HEAT LAMP FOR COUCH POTATOES, DEMANDS PARTICIPATION AND INVOLVEMENT IN DEPTH OF THE WHOLE BEING."

#### THE MEDIUM'S MESSENGER

**MARK DERY** (markdery@well.sf.ca.us) is the author of *Escape Velocity: Cyberculture at the End of the Century* (Grove-Atlantic) and editor of *Flame Wars: The Discourse of Cyberculture* (Duke University Press) and has contributed to *The New York Times*, *Wired*, *Mondo* and other magazines.

"The idea that someone could honestly and openly say 'I defy the Government, I reject what you're doing, I'm going to subvert it' and so on, they simply dismiss."



#### MANUFACTURING DISSENT

**CATHARINE LUMBY** is a New York-based writer and contributes to *World Art* magazine.

**ROSIE CROSS** is a freelance radio producer, writer, video-maker and self-proclaimed geek girl who lives in Sydney, Australia. Her last story for 21•C was an investigation of sexism on the Net. e-mail: Rosie@jolt.mpx.com.au

**CHRIS MOUNTFORD** is a Sydney-based writer with a keen interest in computers and Internet politics. He can be contacted via e-mail at cjmout@extro.ucc.su.oz.au 74774.3004@compuserve.com



#### THE PRICE IS RIGHT

**MCKENZIE WARK** lectures in communications at Macquarie University, Sydney, and writes a column for *The Australian* newspaper. His book *Virtual Geography: Living With Global Media Events* is published by Indiana University Press. His last story for 21•C was on the hype of the infobahn.

# "war was my university"

#### VIRILIO'S APOCALYPSE

**VIRGINIA MADSEN** is a broadcaster on Australia's Radio National.

ALTHOUGH TELEVISION HAS BECOME INCREASINGLY SOPHISTICATED OVER THE YEARS, BASIC BROADCAST TECHNOLOGY HAS CHANGED LITTLE SINCE *I LOVE LUCY* RULED THE AIRWAVES.



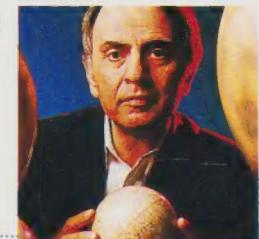
#### THE GRAND DALLIANCE

**ADAM L. PENENBERG** is a New York-based writer and contributor for *The New York Times*.

#### THE MAKING OF INTERACTIVE MAN

**ROSIE CROSS** is a regular Net cruiser, where she conducts most of her interviews.

"If we are to send people to Mars it must be for a very good reason — and with a realistic understanding that almost certainly we will lose lives..."



#### THE RED PLANET

**CARL SAGAN** is professor of astronomy at Cornell University, New York. "Red Planet" in this issue is an excerpt from *Pale Blue Dot: A Vision of the Human Future in Space* published by Headline Hodder.

**"Commentators from William Gibson to Michael Heim frequently describe *Finnegans Wake* as a forerunner of hypertext."**

#### THE BAIRDBOARD BOMBARDMENT

**DARREN TOFTS** is senior lecturer in literature at Swinburne University of Technology in Melbourne, Australia.

#### TECHNO WIZARD

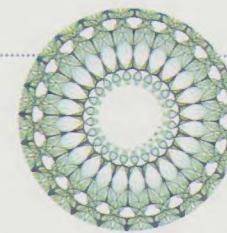
**RICHARD GUILLIATT** is a journalist with *The Sydney Morning Herald*.



**STELARC:** "I THINK THE BEHAVIORISTS' AGENDA OF ERASING THE MIND FROM THE BODY, WAS A VERY HEROIC ATTEMPT TO UNDO THE MUDDLE OF OUR METAPHYSICAL HISTORY."

#### ELECTRONIC VOODOO

**NICHOLAS ZURBRUGG** is a senior lecturer in literary studies at Griffith University in Queensland, contributes to *World Art* magazine, and is the author of *The Parameters of Postmodernism*.



#### THE THEORY OF EVERYTHING

**PHILLIP ADAMS** is host of *Late Night Live* on the ABC's Radio National and a columnist for *The Australian* newspaper. His last story for 21•C was a profile of Michio Kaku.

#### 4.992016

**PAUL DAVIES** is professor of natural philosophy at the University of Adelaide and author of more than 20 popular science books. His latest book is *The Last Three Minutes*. His last story for 21•C was on time travel.

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#### THE WILL TO DISCOVER

**JULIAN BROWN** is a London-based science writer, a former BBC journalist and editor of the British science magazine *Focus*. His last story for 21•C was on traveling at warp speed.

#### PLEASURE DOME

**FRED HARDEN** is editor of *Australian MultiMedia* magazine.

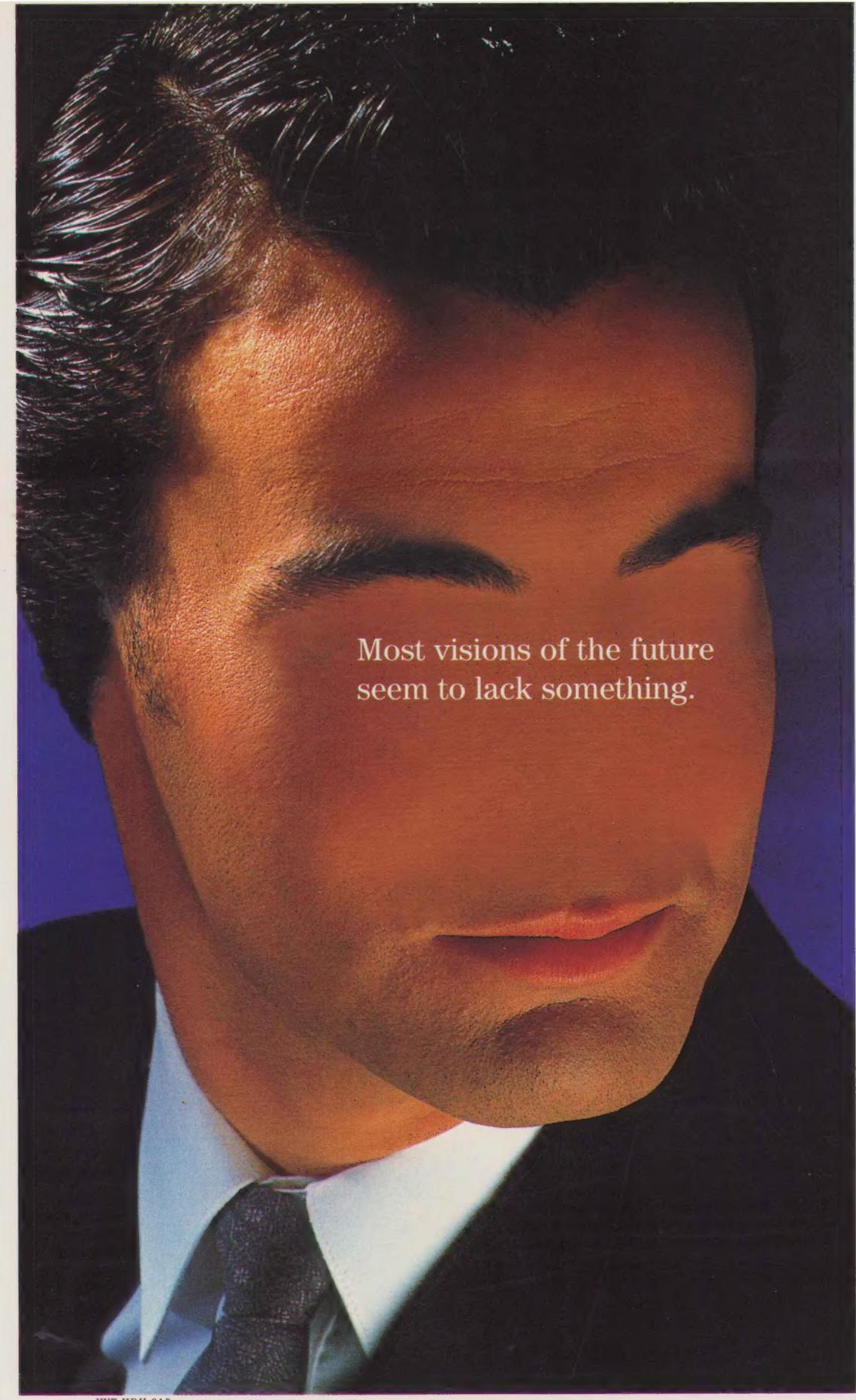
#### @ WORK

**ANDREA MOED** is a New York-based project writer at the interactive design firm Edwin Schlossberg and critiques design and music for 21•C.



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seem to lack something.

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